(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 381 431 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
03.10.2018 Bulletin 2018/40

(51) Int Cl.:
A61J 1/20 *(2006.01)*

(21) Application number: **18171078.1**

(22) Date of filing: **21.04.2015**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **21.04.2014 US 201461982091 P**

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
15721420.6 / 3 134 057

(71) Applicant: **Becton Dickinson and Company Limited**
Dun Laoghaire (IE)

(72) Inventors:
- **Kim, Jayeon**
  Little Ferry, NJ 07643 (US)
- **Sanders, Laurie**
  Glen Ridge, NJ 07028 (US)
- **Cancellieri, Jude**
  Oakland, NJ 07436 (US)

(74) Representative: **dompatent von Kreisler Selting Werner -**
Partnerschaft von Patent- und Rechtsanwälten mbB
Deichmannhaus am Dom
Bahnhofsvorplatz 1
50667 Köln (DE)

Remarks:
This application was filed on 07.05.2018 as a divisional application to the application mentioned under INID code 62.

(54) SYRINGE ADAPTER WITH COMPOUND MOTION DISENGAGEMENT

(57) An adapter for connection with a fluid container includes an outer housing having a distal end, a proximal end, and a generally cylindrical sidewall extending between the distal end and the proximal end, an inner member comprising a body rotatably inserted within the outer housing, a first locking arrangement configured to restrict the inner member from rotating relative to the housing in a first direction, and a second locking arrangement configured to restrict the inner member from rotating relative to the housing in both the first direction and a second direction. The adapter is transitionable between: a disengaged state, in which the first locking arrangement and the second locking arrangement are not engaged with the inner member; a partially engaged state in which the first locking arrangement engages the inner member; and a fully engaged state in which the second locking arrangement engages the inner member.

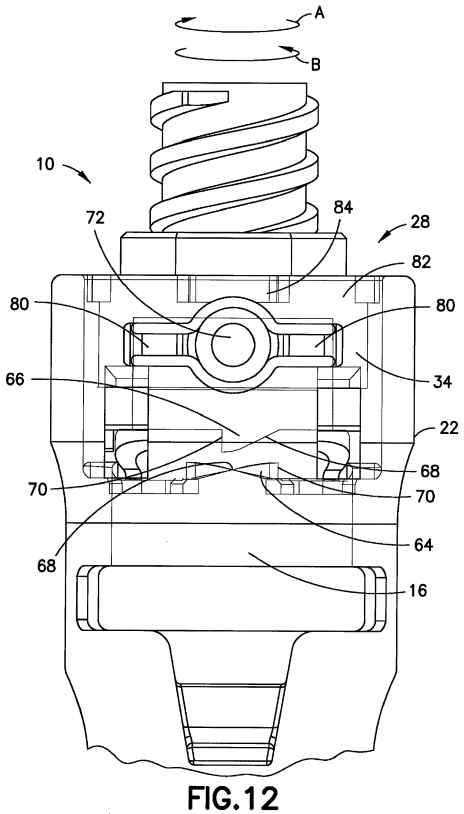

FIG.12

EP 3 381 431 A1

Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to an adapter for a closed system transfer assembly that permits fluid delivery from a first fluid container to a second fluid container through the adapter. More specifically, the invention is directed an adapter with a connection arrangement for engaging and disengaging the adapter from the fluid container.

Description of Related Art

[0002] Healthcare workers, such as pharmacists and nurses, can be subject to acute and long term health risks upon repeated exposure to drugs or solvents which might escape into the air during drug preparation, drug administration, and other similar handling. This problem is particularly serious when cytotoxins, antiviral drugs, antibiotics, and radiopharmaceuticals are concerned. The health risks faced by exposure to these drugs can include the development of cancer, reproductive problems, genetic conditions, and other serious concerns. Other hazardous areas may be sample taking, such as samples concerning virus infections or the like. When performing infusions, it is often necessary to inject a drug or other medical substance into the infusion fluid, inside an infusion bag or other infusion fluid container. This is often done by means of penetrating a septum or other fluid barrier of an injection port on the infusion bag or on the infusion fluid line with a needle of a syringe filled with the medical fluid in question. However, even before this, it may be necessary to transfer the medical fluid from a vial to a syringe and then from the syringe to a secondary container. In each of these steps, staff may be exposed to the medical fluid by means of contamination. Such contamination may be vaporized medical fluid or aerosol in the air. The contaminations may contaminate the staff through their lungs, or by vaporized medical fluid or aerosol in the air which condensates on the skin to thereafter penetrate the skin of the staff. Some medicaments are even known to penetrate protection gloves and thereby contaminate the staff.

[0003] Exposure to contaminations like this may, on a long term basis, give rise to alarmingly high concentrations of medicaments in the blood or the human body of the staff as described above. It has been understood that, due to the many transferring steps between e.g., vials, syringes, infusion systems, etc., the risk for contamination during the actual insertion and retraction of a needle from the container, e.g., a vial, needs to be contained. Closed system transfer devices (CSTD) have been developed to ensure that the medicament is contained in the transfer device during transfer of the medicament.

[0004] Generally, a CSTD includes an adapter (referred to hereinafter as a syringe adapter) for connection to a first fluid container, such as a syringe, and a second adapter (referred to hereinafter as a vial adapter) for connection to a vial, a second syringe, or a conduit providing fluid access to the patient's circulatory system. According to one arrangement, the healthcare practitioner may reconstitute a powdered or lyophilized compound with saline or some other reconstitution medium by attaching the syringe to the vial through the syringe adapter and the vial adapter. The practitioner reconstitutes the drug, aspirates the compound into the syringe, disconnects the adapters, and then attaches the syringe adapter and syringe attached thereto to a patient delivery device, such as an IV line or syringe, for administration to the patient.

[0005] One type of syringe adapter that can be used in a CSTD has a proximal end with a male or female luer-lock element that is arranged to be joined with a corresponding female or male luer-lock element of the syringe. The luer-lock element can be screwed into and unscrewed from the corresponding luer-lock element. It is desirable to prevent accidental or inadvertent unscrewing of the components, which could lead to the disconnection of the fluid passageway extending through the adapter. Such disconnection may result in a serious contamination risk for a patient and/or any other person in the vicinity of the disconnected CSTD. The issue of safety in administration of hazardous medical compounds is one that has been identified as being of critical importance by professional organizations and government agencies alike.

[0006] It is, therefore, desirable to provide a syringe adapter for enabling fluid transfer from the syringe to the syringe adapter, vial adapter, and second fluid container by facilitating a positive connection of the connectors and avoiding inadvertent or accidental disconnection of the syringe and fluid connector. Specifically, it is desirable that the syringe and syringe adapter may be connected together via a simple intuitive connection activity. However, the steps for disconnecting the syringe from the syringe adapter should be more complex so that inadvertent or accidental disconnection is discouraged.

SUMMARY OF THE INVENTION

[0007] In one aspect of the present invention, an adapter for connection with a fluid container includes an outer housing having a distal end, a proximal end, and a generally cylindrical sidewall extending between the distal end and the proximal end, an inner member comprising a body rotatably inserted within the outer housing and a connector extending from the body configured to connect the adapter to a fluid container, a first locking arrangement engageable with the body of the inner member and configured to restrict the inner member from rotating relative to the housing in a first direction, and a second locking arrangement engageable with the body of the inner member and configured to restrict the inner member from rotating relative to the housing in both the first

direction and a second direction. The adapter is transitionable between: a disengaged state, in which the first locking arrangement and the second locking arrangement are not engaged with the inner member; a partially engaged state in which the first locking arrangement engages the inner member; and a fully engaged state in which the second locking arrangement engages the inner member.

[0008] The inner member may be rotatable in both the first direction and the second direction when the connector is in the disengaged state. The inner member may be transitionable from an extended position to a recessed position by applying a compressive force to the inner member.

[0009] The adapter may further include a biasing member that maintains the inner member in the extended position. The biasing member may be a leaf spring.

[0010] The first locking arrangement may include at least one protrusion extending inward from an inner surface of the sidewall of the housing and a corresponding protrusion on the body of the inner member configured to engage the protrusion on the sidewall. The at least one protrusion may extend inward from an inner surface of the sidewall of the housing and the corresponding protrusion on the body of the inner member may be one-way ratchets comprising a sloped face and a substantially vertical face.

[0011] The first locking arrangement may be at least two protrusions positioned on opposing circumferential sides of the sidewall of the housing and at least two corresponding protrusions extending from the body of the inner member. The second locking arrangement may be at least one inwardly extending tab connected to a portion of the sidewall of the housing and configured to selectively engage a portion of the inner member. The second locking arrangement may be at least two inwardly extending tabs positioned on opposing sides of the sidewall of the housing. The at least one tab may be a pressing surface configured such that applying a compressive force to the pressing surface biases the tab inward to engage the portion of the inner member. The tab may be connected to the sidewall of the housing at a flexible joint, such that application of the compressive force to the pressing surface biases the tab inward about the flexible joint. The second locking arrangement may include a beam that connects the tab to the sidewall of the housing, and where applying a compressive force to the pressing surface deflects the beam inward thereby extending the at least one tab toward the inner member. The second locking arrangement may include two beams connected to opposing sides of the tab. The second locking arrangement may include at least one tooth extending radially from the inner member, with the tooth being configured to engage the at least one tab.

[0012] The connector may include an outer surface with helical threads configured to engage corresponding threads on an inner surface of a portion of the fluid container. The connector may be a luer connector configured to receive a corresponding luer connector of the fluid container.

[0013] The inner member may be transitionable from an extended position to a recessed position relative to the outer member, where the inner member is in the disengaged state when in the extended position, and where the inner member is in one of the partially engaged state and the fully engaged state when in the recessed position. The inner member may be in the fully engaged state when the inner member is in the recessed position and when the second locking arrangement is engaged with the body of the inner member.

[0014] In a further aspect of the present invention, a method of disconnecting a fluid container to an adapter includes: providing an adapter comprising an outer housing having a distal end, a proximal end, and a generally cylindrical sidewall extending between the distal end and the proximal end, an inner member comprising a body rotatably inserted within the housing and a connector extending from the body comprising a connector configured to engage with the fluid container, a first locking arrangement engageable with the body of the inner member and configured to restrict the inner member from rotating relative to the housing in a first direction, and a second locking arrangement engageable with the body of the inner member and configured to restrict the inner member from rotating relative to the housing in both the first direction and a second direction; moving the fluid container in an axial direction towards the adapter; engaging the second locking arrangement; and rotating the fluid container to disconnect the fluid container from the inner member of the adapter.

[0015] These and other features and characteristics of the present invention, as well as the methods of operation and functions of the related elements of structures and the combination of parts and economies of manufacture, will become more apparent upon consideration of the following description and the appended claims with reference to the accompanying drawings, all of which form a part of this specification, wherein like reference numerals designate corresponding parts in the various figures. It is to be expressly understood, however, that the drawings are for the purpose of illustration and description only and are not intended as a definition of the limits of the invention. As used in the specification and the claims, the singular form of "a", "an", and "the" include plural referents unless the context clearly dictates otherwise.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

Fig. 1 is a perspective view of closed system transfer device system according to an aspect of the invention.

Fig. 2 is a perspective view of an adapter according to an aspect of the invention.

Fig. 3 is a cross sectional view of the adapter of **Fig.**

2.

Fig. 4 is a perspective view of an inner member of the adapter of **Fig. 2.**

Fig. 5 is a cross sectional view of the inner member of **Fig. 4.**

Fig. 6A is a front view of a portion of an adapter having an inner member in an extended position, according to another aspect of the invention.

Fig. 6B is a front view of the adapter of **Fig. 6A** with the inner member in the recessed position.

Fig. 7 is a front view of a portion of the adapter of **Fig. 2.**

Fig. 8 is a top view of the adapter of **Fig. 2** with the inner member removed therefrom.

Fig. 9A is a front view of the leaf spring of the adapter of **Fig. 2** in a default position.

Fig. 9B is a front view of the leaf spring of **Fig. 9A** in a compressed position.

Fig. 10 is a perspective view of a biasing member according to another aspect of the invention.

Fig. 11 is a perspective view of a biasing member according to another aspect of the invention.

Fig. 12 is a front view of a portion of the adapter of **Fig. 2** with the exterior of the adapter housing being transparent for clarity.

Fig. 13 is a cross section view of a portion of the adapter of **Fig. 2.**

Fig. 14 is a perspective view of a portion of an adapter according to another aspect of the invention.

Fig. 15 is a perspective view of a portion of an adapter according to another aspect of the invention.

Fig. 16 is a cross section view of an adapter according to another aspect of the invention.

Fig. 17 is a perspective view of an aspect of a removal tool connected to the adapter of **Fig. 2** for removing a syringe therefrom.

Fig. 18A is a perspective view of a removal tool for removing a syringe from an adapter according to another aspect of the invention.

Fig. 18B is a perspective view of an adapter according to another aspect of the invention configured to be disconnected from a syringe with the removal tool of **Fig. 18A.**

Fig. 19 is a perspective view of a portion of an adapter according to another aspect of the invention.

Fig. 20 is a perspective view of a portion of an adapter according to another aspect of the invention.

DESCRIPTION OF THE INVENTION

[0017] The illustrations generally show preferred and non-limiting aspects of the systems and methods of the present disclosure. While the descriptions present various aspects of the devices, it should not be interpreted in any way as limiting the disclosure. Furthermore, modifications, concepts, and applications of the disclosure's aspects are to be interpreted by those skilled in the art as being encompassed by, but not limited to, the illustrations and descriptions herein.

[0018] Further, for purposes of the description hereinafter, the terms "end", "upper", "lower", "right", "left", "vertical", "horizontal", "top", "bottom", "lateral", "longitudinal", and derivatives thereof shall relate to the disclosure as it is oriented in the drawing figures. The term "proximal" refers to the direction toward the center or central region of the device. The term "distal" refers to the outward direction extending away from the central region of the device. However, it is to be understood that the disclosure may assume various alternative variations and step sequences, except where expressly specified to the contrary. It is also to be understood that the specific devices and processes illustrated in the attached drawings, and described in the following specification, are simply exemplary aspects of the disclosure. Hence, specific dimensions and other physical characteristics related to the aspects disclosed herein are not to be considered as limiting. For the purpose of facilitating understanding of the disclosure, the accompanying drawings and description illustrate preferred aspects thereof, from which the disclosure, various aspects of its structures, construction and method of operation, and many advantages may be understood and appreciated.

[0019] With reference to **Fig. 1,** a closed system transfer assembly **2** is illustrated. The closed system transfer assembly **2** includes a first fluid source or container, such as a syringe **4** or IV line, configured to be connected to a syringe adapter (referred to hereinafter as adapter **10**). The syringe **4** includes a male luer connector **6** that is configured to be secured to a corresponding female luer-lock connector **12** of the adapter **10.** However, it is understood that the arrangement of the male and female luer-lock fittings may be reversed for certain fluid delivery applications. Any other connection interface, as is known in the art, may also be added in place of the luer fittings as required. The distal end of the syringe **4** may also include a luer-lock **8** surrounding the male luer connector **6** with threads **9** configured to engage corresponding threads **14** surrounding the connector **12.** More specifically, the adapter **10** is an assembly of components adapted to create a tamper-proof connection interface with the syringe **4.** The adapter **10** is configured to prevent accidental or inadvertent disconnection of the adapter **10** and the syringe **4,** which could compromise the integrity of the closed system transfer assembly **2.** As will be described in detail hereinafter, the adapter **10** includes various locking arrangements for preventing a user from inadvertently disengaging the adapter **10** from the syringe **4.** As a result of the locking arrangements, to disengage the syringe **4** from the adapter **10,** the user must perform a compound motion activity. As referred to hereinafter, a compound motion activity refers to more than one distinct and independent motion performed in a predetermined order or sequence. For example, in one aspect of the adapter **10,** the compound motion activity includes at least three distinct motions, namely pressing the syringe **4** toward the adapter **10,** pressing a button, tab, or

surface located on a sidewall of the adapter **10,** and rotating the syringe **4** relative to the adapter **10** to disengage the threads **14** of the connector **10** from the threads **9** on the luer-lock **8** of the syringe **4.** The sequence of predetermined steps may also be reversed or performed in a different order within the scope of the present invention.

[0020] With reference to **Figs. 2** and **3,** the adapter **10** includes an outer housing **16** having a distal end **18,** a proximal end **20,** and a generally cylindrical sidewall **22** extending between the distal end **18** and the proximal end **20.** The housing **16** defines a fluid passageway **24** (shown in **Fig. 3**) extending between the proximal end **20** and distal end **18** of the outer housing **16.** The housing **16** may be formed from any suitable structural material including medical grade plastic or metal. Optionally, the housing **16** may include various features that make holding or manipulating the housing **16** and adapter **10** easier. For example, the housing **16** may include a narrower grip portion **26** that is more comfortable for users to hold. The housing **16** may also include a textured portion or surface (not shown) so that the housing **16** does not slip or slide when held by the user. The housing **16** may also include various aesthetic features such as patterns, designs, logos, and the like for improving the appearance of the outer housing **16.**

[0021] With continued reference to **Figs. 2** and **3,** in certain aspects, the housing **16** includes a needle cannula **25** extending therethrough that forms the fluid passageway **24.** The cannula **25** may include a tip at a distal end thereof for establishing a fluid connection with a fluid container such as a medical vial. The housing may also include a septum (not shown) or seal arrangement, capable of being pierced by the tip of the needle, extending across an inner portion of the housing **16.** During use, the needle tip and cannula **25** may be advanced through the septum or seal arrangement to establish fluid communication through the housing **16.** The septum or seal arrangement may be configured to prevent fluid from passing through the housing **16** and contaminating other elements of the adapter **10** and/or syringe **4.**

[0022] The adapter **10** further includes an inner member **28** inserted in the proximal end **20** of the housing **16.** For example, in one aspect, the inner member **28** may be inserted in an annular sleeve **30** extending around the proximal end **20** of the housing **16.** As will be described hereinafter, an inner surface **32** (shown in **Fig. 3**) of the sidewall **22** may include various structures for engaging the inner member **28** to restrict rotation thereof. The inner member **28** includes a substantially cylindrical body **34** having an outer diameter OD that generally corresponds with the inner diameter ID of the sidewall **22** of the housing **16.** The adapter **10** also includes a first locking arrangement **36** that is capable of engaging with the body **34** of the inner member **28** for restricting the inner member **28** from turning in a first direction A, such as clockwise, and a second locking arrangement **38** that is capable of engaging with body **34** of the inner member **28** for restricting the inner member **28** from turning in both the first direction A and a second direction **B,** such as counter clockwise.

[0023] As will be described in greater detail hereinafter, the adapter **10** is transitionable between three states or positions. First, the adapter **10** may be in a disengaged state, in which the first locking arrangement **36** and the second locking arrangement **38** are not engaged with the inner member **28.** In the disengaged state, the inner member **28** can freely rotate relative to the stationary outer housing **16** in both the first direction A and the second direction B. Second, the adapter **10** may be in a partially engaged state. In the partially engaged state, the first locking arrangement engages **36** the inner member **28** so that rotation in direction A is substantially prevented. Finally, the adapter **10** may be transitioned to a fully engaged state or position in which the second locking arrangement **38** engages the inner member **28,** thereby preventing the inner member **28** from rotating substantially freely in either the first direction A or the second direction B. It is noted, however, that some rotation may still occur in the partially engaged and fully engaged states if the locking arrangements **36, 38** have not reached a hard stop or if the user is not gripping the locking arrangements **36, 38** strongly enough to fully prevent rotation of the inner member **28.**

[0024] With reference to **Figs. 2-5,** the body **34** of the inner member **28** is a substantially cylindrical structure, although other suitable shapes may be utlized. The body **34** may include a cap **40** or top on a proximal end thereof. The cap **40** covers a portion of the proximal end of the body **34** and, when inserted in the housing **16,** also covers at least a portion of the proximal end **20** of the housing **16.** The connector **12** extends from the cap **40** of the body **34** and is positioned such that the fluid passageway **24** extends therethrough. For example, a proximal end of the cannula **25** (shown in **Fig. 3**) may be inserted into a distal end **44** (shown in **Fig. 5**) of the connector **12** for permitting fluid flow through the housing **16** of the adapter **10.**

[0025] The connector **12** includes various structures for connecting the inner member **28** of the adapter **10** to the syringe **4** (shown in **Fig. 1**). As described above, in one aspect, the exterior sidewall of the connector **12** includes helical threads **14** extending therefrom. The threads **14** are configured to engage corresponding threads **9** on the syringe **4** (shown in **Fig. 1**). For example, the user may connect the syringe **4** to the connector **10** by twisting the syringe **4** in a direction A.

[0026] In certain aspects, the inner member **28** also includes a pedestal **46** or base located between the body **34** of the inner member **28** and the connector **12.** The pedestal **46** includes at least one flat **47.** For example, the pedestal **46** may include opposing flats **47** on either side of the pedestal **46.** As will be described hereinafter, the flats **47** are configured to be connected with a removal tool **100** (shown in **Fig. 17**), such as a wrench. The removal tool **100** prevents the inner member **28** from rotating relative to the housing **16,** making it easier to remove the syringe **4** from the adapter **10.**

[0027] With reference to **Fig. 7** and as described above, the inner member **28** is configured to be inserted in the proximal end **20** of the housing **16** of the adapter **10.** Optionally, the housing **16** may include structures for maintaining the inner member **28** in the housing **16.** For example, the adapter **10** may include a snap fit mechanism **48** configured to engage a portion of the inner member **28.** The snap fit mechanism **48** may include a ledge **50** or ring extending from a portion of the sidewall **22** of the housing **16.** A corresponding ledge **52** or ring on the body **34** of the inner member **28** is configured to contact the ledge **50** or ring for maintaining the inner member **28** in the housing **16.** In certain aspects, a window **54** on the sidewall **22** of the housing **16** allows the user to determine when the snap fit connection is established.

[0028] With reference to **Figs. 6A** and **6B,** the inner member **28** is configured to be transitionable from an extended position (shown in **Fig. 6A**) to a recessed position (shown in **Fig. 6B**) in which the inner member **28** is inserted farther into the outer housing **16.** The user advances the inner member **28** in the distal direction D, relative to the housing **16,** to transition the inner member **28** from the extended position to the recessed position by applying a compressive force thereto. As will be described hereinafter, the first locking arrangement **36** (shown in **Figs. 2** and **3**) and second locking arrangement **38** cannot engage the inner member **28** when it is in the extended position. When the inner member **28** is in the recessed position, the first locking arrangement **36** and/or second locking arrangement **38** are capable of engaging the inner member **28** to restrict rotation of the inner member **28** relative to the outer housing **16** in the first direction A and/or in the second direction B.

[0029] With reference to **Figs. 3** and **8,** the adapter **10** may further include a biasing member, such as a leaf spring **56,** connected between the housing **16** and inner member **28** (shown in **Fig. 3**). The leaf spring **56** includes two or more flexible arms **62** that may be moved from a default position (shown in **Fig. 9A**) to a compressed position (shown in **Fig. 9B**). In certain aspects, the leaf spring **56** is a single molded structure. The leaf spring **56** may also be molded as two or more separate components connected together through the inner member **28.** The leaf spring **56** may also be integrally formed with the inner member **28.** As will be appreciated by one having ordinary skill in the art, the outer diameter of the ring formed by the flexible arms **62** increases as the spring **56** is compressed from the default position to the compressed position. In other aspects, the leaf spring **56** may also be configured with a constant outer diameter in both the default and compressed positions. The leaf spring **56** may include a bottom **58** or foot configured to be received within a groove **60** (shown in **Fig. 8**) extending from a portion of the sidewall **22** of the housing **16.** With specific reference to **Fig. 3,** the leaf spring **56** is configured to bias the inner member **28** in the proximal direction P relative to the outer housing **16** to counteract compressive force applied to the inner member **28** by the user. Accordingly, when compressive force is not applied to the inner member **28,** the leaf spring **56** maintains the inner member **28** in the extended position. As previously described, when the inner member **28** is in the extended position, the first locking arrangement **36** and the second locking arrangement **38** cannot engage the inner member **28.** Thus, the inner member **28** is freely rotatable in both direction A and direction B. The user may transition the inner member **28** to the recessed position by applying a compressive force thereto in the distal direction D that is sufficient to overcome the biasing force of the leaf spring **56.**

[0030] As described above, the adapter **10** of the present disclosure is configured to require a compound motion or activity to disconnect the syringe **4** (shown in **Fig. 1**) from the adapter **10.** In a preferred and non-limiting aspect of the adapter **10,** the first activation motion or maneuver is considered to be pressing the inner member **28** in the distal direction D with a compressive force that is sufficient to counteract the biasing force of the leaf spring **56.** This activity may be performed, for example, when pressing the male luer-lock **6** (shown in **Fig. 1**) into the corresponding female luer-lock fitting of the connector **12.**

[0031] With reference to **Figs. 10** and **11** alternative aspects of leaf springs **56** are illustrated. Specifically, in **Fig. 10,** the leaf spring **56** includes a portion of the first locking arrangement **36.** In that case, the body **34** of the inner member **28** can be a monolithic piece that can be used in a variety of applications, regardless of the structure of the first locking arrangement **36.** As will be described hereinafter, the first locking arrangement **36** interacts with a corresponding portion of the sidewall **22** of the housing **16** to limit rotation of the inner member **28.** In **Fig. 11,** an aspect of the leaf spring **56** with opposing flexible joints **64** connecting the flexible arms **62** together is illustrated. The flexible joints **64** ensure that the spring **56** can transition to the compressed position without substantially increasing the diameter of the spring **56.**

[0032] Having generally described the structure of aspects of the outer housing **16,** inner member **28,** and leaf spring **56** of the adapter **10,** the structure of the first locking arrangement **36** and the second locking arrangement **38,** which restrict rotation of the inner member **28** in the first direction A and/or the second direction B, will now be discussed.

[0033] With reference to **Figs. 3** and **12,** as described hereinabove, when the inner member **28** is in the recessed position, the first locking arrangement **36** is capable of engaging a portion of the body **34** of the inner member **28,** thereby preventing the user from rotating the inner member **28** in the first direction A, but permitting rotation in the second direction **B.** With specific reference to **Fig. 12,** in certain aspects, the first locking arrangement **36** includes at least one protrusion **64** extending inward from the inner surface of the sidewall **22** of the housing **16.** A corresponding protrusion **66** on the body **34** of the inner member **28** is configured to contact the

protrusion **64** on the sidewall of the housing **16** when the inner member **28** is in the recessed position. The protrusions **64, 66** may be corresponding one-way ratchet structures. For example, each protrusion **64, 66** may include a sloped face **68** and a vertical face **70.** As will be appreciated by one having skill in the art, the vertical face **70** of the protrusions **64, 66** engage each other to prevent rotation of the inner member in direction A. When the inner member **28** is rotated in direction B, the sloped faces **68** of corresponding protrusions **64, 66** slide against one another to allow movement or rotation of the inner member **28.**

[0034] The protrusions **66, 64** may be arranged in a variety of configurations about the circumference of the body **34** of the inner member **28** and inner surface of the sidewall **22.** For example, the adapter **10** may include two protrusions **64** extending from the inner sidewall **22** of the housing **16** and two corresponding protrusions **66** on the body **34** of the inner member **28.** The protrusions **64, 66** may be positioned on opposing sides of the inner member **28** and sidewall **22.** The adapter **10** may also include four or more protrusions 64, **66** placed at equidistant points about the sidewall **22** and inner member **28.** Furthermore, the sidewall **22** may include a different number of protrusions **64** than the inner member **28.** For example, in one aspect of the inner member **28,** the body **34** of the inner member **28** includes two protrusions **64** on opposing sides thereof. The sidewall **22** may include four or more protrusions **66.** In this way, the user does not have to twist the inner member **28** as far before engagement between the protrusions **64, 66** is established.

[0035] With reference to **Figs. 3** and **13,** when the inner member **28** is in the recessed position, the second locking arrangement **38** is capable of engaging the inner member **28** to prevent the inner member **28** from rotating in either the first direction A or the second direction B. The second locking arrangement **38** includes at least one inwardly extending tab 72 connected to a portion of the sidewall **22** of the housing **16** and configured to selectively engage a portion of the inner member **28.** In certain aspects, the adapter **10** includes two or more tabs **72** on opposite sides of the housing **16.** Optionally, additional tabs **72** may also be positioned around the sidewall **22** of the housing **16** to impart additional engagement force to the inner member 28 when needed for specific applications. In addition, the adapter **10** may include various fake buttons (not shown) or surfaces spaced about the adapter **10** for aesthetic purposes, such as to give the adapter **10** a more symmetrical appearance. The housing **16** may also be structured to hide the tabs **72** to make them less obvious, thereby improving the appearance of the adapter **10.**

[0036] Each tab **72** includes a pressing surface **74,** such as a button, swing arm, or tab, located on an outer side thereof, configured to be pressed by the user. The tab **72** also includes an inner surface **76** configured to contact and engage a portion of the inner member **28.** The user applies a compressive force to the pressing surface **74** of each tab **72,** thereby biasing the tab **72** in an inward direction toward the inner member **28.** For example, in one aspect, the pressing surface **76** of the tab **72** is configured to contact a smooth surface of the body **34** of the inner member **28** to form a frictional engagement therewith. The tab **72** is connected to the sidewall **22** through one or more beams **80** connected between the tab **72** and sidewall **22.** For example, the aspect of the adapter **10** illustrated in **Figs. 12** and **13** includes two beams **80** connected on opposite sides of the tab **72.** The aspect of the adapter **10** illustrated in **Fig. 14** includes only one beam **80** connected to the tab **72.** A user may press the pressing surface **74** of the tab **72** causing the beam **80** to deflect inward and bringing an inner surface **76** of the tab **72** into contact with the inner member **28** to restrict rotation thereof.

[0037] With reference to **Fig. 15,** in certain other aspects, the tab **72** may be a swing tab that is directly connected to the sidewall **22** of the housing **16** at a flexible joint **78.** Applying compressive force to the tab **72** causes it to rotate inward relative to the joint **78** bringing the inner surface **76** into contact with the inner member **28.**

[0038] With reference again to **Figs. 12** and **13,** the inner member **28** may include various structures for strengthening, reinforcing, or optimizing the engagement between the inner surface **76** of the tab **72** and the inner member **28.** For example, in one aspect, the inner member **28** includes protrusions, such as at least one radially extending tooth **82,** extending from a skirt or surface **84** of the body **34.** In one aspect, a number of teeth **82** may be arranged around a circumference of the surface **84** to form a ring of radially extending teeth **82.** As the tab **72** is biased in an inward direction toward the inner member **28,** the pressing surface **76** of the tab **72** engages the inner member **28.** More specifically, the pressing surface **76** may engage the surface **84** at a region between adjacent teeth **82,** thereby forming an interference engagement that restricts or prevents rotation of the inner member **28** relative to the housing **16.**

[0039] With reference to **Fig. 16,** in a preferred and non-limiting aspect, the adapter **10** further includes a membrane housing **86** inserted within the outer housing **16.** The membrane housing **86** supports or holds a septum or membrane (not shown). The septum or membrane prevents fluid or gas from passing to the atmosphere through the interior of the adapter **10.** The membrane housing **86** is capable of moving within the outer housing **16.** In one position, such as when the adapter **10** is connected to a mating connector or component, the membrane housing **86** is adjacent to the distal end of the inner member **28** and partially surrounded by the leaf spring **56.** In this position, the membrane housing **86** prevents the inner member **28** from biasing the leaf spring **56** and transitioning from the extended position to the recessed position. Accordingly, the membrane housing **86** also prevents the one-way ratchet structures of the first locking arrangement **36** (not shown in **Fig. 16**) or tabs **72** and pressing surfaces **76** of the second locking arrangement

38 from contacting and engaging the inner member **28** to restrict rotation thereof. Therefore, when the membrane housing **86** is adjacent to the inner member **28,** the inner member **28** is held in the extended position and spins freely in direction A and direction B. As such, it would be difficult to remove the syringe **4** (shown in **Fig. 1**) from the connector **12** when the membrane housing **86** is in the position adjacent to the inner member **28** illustrated in **Fig. 16.**

[0040] Having discussed the closed transfer system assembly **2** and structure of the adapter **10,** steps for connecting the syringe **4** to and disconnecting the syringe **4** from the adapter **10** will now be discussed in detail. As described hereinabove, the adapter **10** is configured so that the syringe **4** can be connected to the adapter **10** through a series of intuitive and easy connection steps. The adapter **10** is configured such that the steps for removing the syringe **4** from the adapter **10,** referred to as compound motion disengagement, require more deliberate action by the user, thereby preventing the user from inadvertently or accidentally removing the syringe **4** from the adapter **10.**

[0041] With reference to **Figs. 1-3,** to connect the syringe **4** to the adapter **10,** the user grasps the syringe **4** in a conventional manner. The user aligns the distal portion of the syringe **4** with the connector **12** of the adapter **10,** such that helical threads **14** of the connector **12** contact corresponding threads **9** on the shield **8** surrounding the male luer lock **6** of the syringe **4.** It is noted, however, that since the adapter **10** is in the disengaged position, the inner member **28** spins freely in both the first direction A and the second direction **B.** Therefore, if the user were to try to turn the syringe **4** relative to the connector **12,** the inner member **28** would also rotate preventing connection therebetween. Instead, the user must press the syringe **4** against the connector **12** in distal direction D with sufficient compressive force to overcome the biasing force of the leaf spring **56.** Once sufficient force is applied, the inner member **28** is transitioned to the recessed position.

[0042] In the recessed position, the protrusions **64, 66** (shown in **Figs. 12** and **13**) of the first locking arrangement **36** are brought into contact with one another. More specifically, once the inner member **28** is in the recessed position, the user can slightly rotate the inner member **28** relative to the housing **16** to established contact and/or engagement between the protrusions **66** of the inner member **28** and protrusions **64** extending from the housing **16.** Once the engagement between the first locking arrangement **36** and inner member **28** is established, the inner member **28** is prevented from rotating any farther in the first direction A. Thus, the user can rotate the syringe **4** in direction A relative to the connector **12** to engage the threads **9** of the syringe **4** with the corresponding helical threads **14** of the connector **12.** Since the inner member **28** is fixedly engaged with the first locking arrangement **36,** twisting the syringe **4** in direction A does not cause the inner member **28** to rotate.

[0043] Once the syringe **4** is sufficiently tightly connected to the connector **12** of the inner member **28,** the user can release the syringe **4.** When the syringe **4** is released, the leaf spring **56** biases the inner member **28** back to the extended position. In the extended position, the inner member **28** and syringe **4** attached thereto can freely rotate in either direction relative to the housing **16.** Furthermore, since the inner member **28** rotates in conjunction with rotation of the syringe **4,** it would be rather difficult or impossible for the user to remove the syringe **4** from the connector **12** of the inner member **28** when it is in the extended position. Thus, the chance that the user or patient could inadvertently remove the syringe **4** from the adapter **10** is effectively reduced.

[0044] To remove the syringe **4** from the adapter **10,** the user first pushes the syringe **4** toward the adapter **10,** in the same manner described above, to transition the inner member **28** from the extended position to the recessed position. This action is referred to as the first motion or maneuver. Specifically, to disconnect the syringe 4 from the connector **12,** the user must rotate the syringe **4** in direction B. However, when the adapter **10** is in the partially engaged position in which it cannot rotate in direction A, it is free to rotate in direction B, meaning that removing the syringe **4** from the connector **12** would be difficult or prevented. Therefore, the user must press the pressing surfaces **74** of the tabs **72** of the second locking arrangement **38.** Pressing the tabs **72** is referred to as the second motion or maneuver. Pressing the pushing surfaces **74** causes the tabs **72** to contact and engage the inner member **28.** The second locking arrangement **38** prevents the inner member **28** from rotating in either direction A or direction B. Since, in this position, the inner member **28** is prevented from rotating in direction B, the user can easily twist the syringe **4** in direction **B** to unscrew it from the connector **12.** The second locking arrangement **38,** however, cannot be engaged when the inner member **28** is in the extended positioned. Unscrewing the syringe **4** from the connector **12** is referred to as the third motion of maneuver.

[0045] With reference to **Fig. 17,** according to another aspect of the invention, a removal tool **100** for removing the syringe **4** (shown in **Fig. 1**) from the inner member **28** of the adapter **10** is illustrated. The removal tool **100** includes a u-shaped jaw **110** that is configured to contact opposing flats **47** of the pedestal **46** of the inner member **28.** When the removal tool **100** is connected to the flats **47,** the inner member **28** is prevented from rotating even when it is in the extended position. More simply, the removal tool **100** holds the inner member **28** in place. As such, a user can easily remove the syringe **4** from the adapter **10** without having to manipulate the inner member **28** to engage one of the locking arrangements **36, 38** (shown in **Fig. 3**). Advantageously, the removal tool **100** could be used if a user must frequently disconnect syringes **4** (shown in **Fig. 1**) from adapters **10** or in situations in which the user must wear heavy gloves to avoid contacting toxic substances. In such cases, the heavy

gloves may make performing the compound motion activities described herein for removing the syringe **4** from the adapter **10** too difficult to perform on a regular basis.

[0046] With reference to **Fig. 18A,** another aspect of a removal tool **100** is illustrated. The removal tool **100** includes a handle **112** having one or more substantially straight legs **114** extending from a distal end thereof. The legs **114** have a substantially circular cross section and are configured to be inserted in a corresponding hole **90** (shown in **Fig. 18B**), with a corresponding cross section, extending inward from the cap **40** of the inner member **28.** The user inserts the legs **114** of the removal tool **100** into the corresponding holes of the inner member **28.** When removing the syringe **4** (shown in **Fig. 1**) from the adapter **10,** the user holds the handle **112** of the removal tool **100** with sufficient force to prevent the removal tool **100** and inner member **28** from rotating. In this way, the holes **90** function in a similar manner to the above described pedestal, in that the holes **90** provide a structure or mechanism that engages the removal tool **100** to the inner member **28.**

[0047] With reference to **Figs. 19** and **20,** additional aspects of adapters **10** with structures for preventing rotation of the inner member **28** relative to the grip housing **16** are illustrated. With specific reference to **Fig. 19,** grasping surfaces, such as one or more wings **92,** may extend from the distal surface of the cap **40** of the inner member **28.** When disconnecting the syringe **4** (shown in **Fig. 1**) from the inner member **28,** the user can grasp the wings **92** with one hand with sufficient force to prevent the inner member **28** from rotating. In certain other aspects, the grasping surfaces may be raised ridges, tabs, thumb grooves, or other protrusions, as are known in the art. The grasping surfaces, such as the wings **92** illustrated in **Fig. 19,** may be easier for a user to hold for certain shapes of fluid sources or syringes and provide an alternative to the tabs **72** of the second locking arrangement **38** described above in connection with other aspects.

[0048] With specific reference to **Fig. 20,** the housing **10** may also include a deformable portion extending about the portion adjacent to the inner member **28.** The deformable portion **94** is capable of being pressed against the inner member **28** to restrict rotation thereof. The deformable portion **94** may include recessed pressing surfaces **96** having a curvature that can easily be grasped by the user. When sufficient squeezing force is applied to the pressing surfaces **76,** the deformable portion **94** of the housing **16** is biased against the inner member **28** preventing rotation thereof. In certain aspects, the deformable portion **94** of the housing **16** may also include slots **98** adjacent to the pressing surfaces **96.** The slots **98** minimize the disconnection force between the deformable portion **94** of the housing **16** and the inner member **28** by limiting the area of contact therebetween. The deformable portion **94** of the housing **16** provides yet another removal option for the user.

[0049] Although the invention has been described in detail for the purpose of illustration based on what is currently considered to be the most practical and preferred aspects, it is to be understood that such detail is solely for that purpose and that the invention is not limited to the disclosed aspects, but, on the contrary, is intended to cover modifications and equivalent arrangements that are within the spirit and scope of the appended claims. For example, it is to be understood that the present invention contemplates that, to the extent possible, one or more features of any aspect can be combined with one or more features of any other aspect.

FURTHER ASPECTS OF THE INVENTION

[0050]

1. An adapter for connection with a fluid container comprising:

an outer housing having a distal end, a proximal end, and a generally cylindrical sidewall extending between the distal end and the proximal end;
an inner member comprising a body rotatably inserted within the outer housing and a connector extending from the body configured to connect the adapter to a fluid container;
a first locking arrangement engageable with the body of the inner member and configured to restrict the inner member from rotating relative to the housing in a first direction; and
a second locking arrangement engageable with the body of the inner member and configured to restrict the inner member from rotating relative to the housing in both the first direction and a second direction,
wherein the adapter is transitionable between: a disengaged state, in which the first locking arrangement and the second locking arrangement are not engaged with the inner member; a partially engaged state in which the first locking arrangement engages the inner member; and a fully engaged state in which the second locking arrangement engages the inner member.

2. The adapter according to Aspect 1, wherein the inner member is rotatable in both the first direction and the second direction when the connector is in the disengaged state.

3. The adapter according to Aspect 1, wherein the inner member is transitionable from an extended position to a recessed position by applying a compressive force to the inner member.

4. The adapter according to Aspect 3, further comprising a biasing member that maintains the inner member in the extended position.

5. The adapter according to Aspect 4, wherein the biasing member is a leaf spring.

6. The adapter according to Aspect 3, wherein the first locking arrangement comprises at least one protrusion extending inward from an inner surface of the sidewall of the housing and a corresponding protrusion on the body of the inner member configured to engage the protrusion on the sidewall.

7. The adapter according to Aspect 6, wherein the at least one protrusion extending inward from an inner surface of the sidewall of the housing and the corresponding protrusion on the body of the inner member are one-way ratchets comprising a sloped face and a substantially vertical face.

8. The adapter according to Aspect 1, wherein the first locking arrangement comprises at least two protrusions positioned on opposing circumferential sides of the sidewall of the housing and at least two corresponding protrusions extending from the body of the inner member.

9. The adapter according to Aspect 1, wherein the second locking arrangement comprises at least one inwardly extending tab connected to a portion of the sidewall of the housing and configured to selectively engage a portion of the inner member.

10. The adapter according to Aspect 1, wherein the second locking arrangement comprises at least two inwardly extending tabs positioned on opposing sides of the sidewall of the housing.

11. The adapter according to Aspect 9, wherein the at least one tab comprises a pressing surface configured such that applying a compressive force to the pressing surface biases the tab inward to engage the portion of the inner member.

12. The adapter according to Aspect 11, wherein the tab is connected to the sidewall of the housing at a flexible joint, such that application of the compressive force to the pressing surface biases the tab inward about the flexible joint.

13. The adapter according to Aspect 11, wherein the second locking arrangement further comprises a beam that connects the tab to the sidewall of the housing, and wherein applying a compressive force to the pressing surface deflects the beam inward thereby extending the at least one tab toward the inner member.

14. The adapter according to Aspect 13, wherein the second locking arrangement comprises two beams connected to opposing sides of the tab.

15. The adapter according to Aspect 9, wherein the second locking arrangement further comprises at least one tooth extending radially from the inner member, the tooth being configured to engage the at least one tab.

16. The adapter according to Aspect 1, wherein the connector comprises an outer surface with helical threads, configured to engage corresponding threads on an inner surface of a portion of the fluid container.

17. The adapter according to Aspect 16, wherein the connector comprises a luer connector configured to receive a corresponding luer connector of the fluid container.

18. The adapter according to Aspect 1, wherein the inner member is transitionable from an extended position to a recessed position relative to the outer member, wherein the inner member is in the disengaged state when in the extended position, and wherein the inner member is in one of the partially engaged state and the fully engaged state when in the recessed position.

19. The adapter according to Aspect 18, wherein the inner member is in the fully engaged state when the inner member is in the recessed position and when the second locking arrangement is engaged with the body of the inner member.

20. A method of disconnecting a fluid container to an adapter comprising:

providing an adapter comprising:

an outer housing having a distal end, a proximal end, and a generally cylindrical sidewall extending between the distal end and the proximal end;
an inner member comprising a body rotatably inserted within the housing and a connector extending from the body comprising a connector configured to engage with the fluid container;
a first locking arrangement engageable with the body of the inner member and configured to restrict the inner member from rotating relative to the housing in a first direction; and
a second locking arrangement engageable with the body of the inner member and configured to restrict the inner member from rotating relative to the housing in both the first direction and a second direction;

moving the fluid container in an axial direction

towards the adapter;
engaging the second locking arrangement; and rotating the fluid container to disconnect the fluid container from the inner member of the adapter.

Claims

1. An adapter for connection with a fluid container comprising:

   an outer housing having a distal end, a proximal end, and a generally cylindrical sidewall extending between the distal end and the proximal end;
   an inner member comprising a body rotatably inserted within the outer housing and a connector extending from the body configured to connect the adapter to a fluid container, a first locking arrangement engageable with the body of the inner member and configured to restrict the inner member from rotating relative to the housing in a first direction;
   wherein a second locking arrangement engageable with the body of the inner member is configured to restrict the inner member from rotating relative to the housing in both the first direction and a second direction, and
   wherein the adapter is transitionable between: a disengaged state, in which the first locking arrangement and the second locking arrangement are not engaged with the inner member; a partially engaged state in which the first locking arrangement engages the inner member; and a fully engaged state in which the second locking arrangement engages the inner member.

2. The adapter according to claim 1, wherein the inner member defining a removal interface configured to be engaged to prevent rotation of the inner member relative to the outer housing;

3. The adapter according to claim 1, wherein the removal interface comprises a tool engagement surface, wherein the tool engagement surface preferably comprises opposing flat surfaces and/or comprises at least one hole.

4. The adapter according to claim 1, wherein the removal interface comprises at least one wing defining a grasping surface and/or wherein the inner member is rotatable in both the first direction and the second direction when the connector is in the disengaged state.

5. The adapter according to claim 1, wherein the inner member is transitionable from an extended position to a recessed position by applying a compressive force to the inner member.

6. The adapter according to claim 5, further comprising a biasing member that maintains the inner member in the extended position.

7. The adapter according to claim 5, wherein the first locking arrangement comprises at least one protrusion extending inward from an inner surface of the sidewall of the housing and a corresponding protrusion on the body of the inner member configured to engage the protrusion on the sidewall.

8. The adapter according to claim 7, wherein the at least one protrusion extending inward from an inner surface of the sidewall of the housing and the corresponding protrusion on the body of the inner member are one-way ratchets comprising a sloped face and a substantially vertical face.

9. The adapter according to claim 1, wherein the first locking arrangement comprises at least two protrusions positioned on opposing circumferential sides of the sidewall of the housing and at least two corresponding protrusions extending from the body of the inner member.

10. The adapter according to claim 1, wherein the second locking arrangement comprises at least one inwardly extending tab connected to a portion of the sidewall of the housing and configured to selectively engage a portion of the inner member.

11. The adapter according to claim 1, wherein the second locking arrangement comprises at least two inwardly extending tabs positioned on opposing sides of the sidewall of the housing, wherein the at least one tab preferably comprises a pressing surface configured such that applying a compressive force to the pressing surface biases the tab inward to engage the portion of the inner member.

12. The adapter according to claim 1, wherein the connector comprises an outer surface with helical threads, configured to engage corresponding threads on an inner surface of a portion of the fluid container, wherein the connector preferably comprises a luer connector configured to receive a corresponding luer connector of the fluid container.

13. A syringe adapter assembly comprising:

    a syringe adapter comprising:

    an outer housing having a distal end, a proximal end, and a generally cylindrical sidewall extending between the distal end and the proximal end;
    an inner member comprising a body rotatably inserted within the outer housing and

a connector extending from the body configured to connect the adapter to a fluid container, the inner member defining a removal interface;

a first locking arrangement engageable with the body of the inner member and configured to restrict the inner member from rotating relative to the housing in a first direction; and

a second locking arrangement engageable with the body of the inner member and configured to restrict the inner member from rotating relative to the housing in both the first direction and a second direction,

wherein the adapter is transitionable between: a disengaged state, in which the first locking arrangement and the second locking arrangement are not engaged with the inner member; a partially engaged state in which the first locking arrangement engages the inner member; and a fully engaged state in which the second locking arrangement engages the inner member; and

a removal tool configured to engage the removal interface of the inner member to prevent rotation of the inner member relative to the outer housing.

14. The assembly according to claim 13, wherein the removal interface comprises opposing flat surfaces and the removal tool comprises a U-shaped jaw configured to contact the opposing flat surfaces.

15. The assembly according to claim 13, wherein the tool engagement surface comprises a pair of holes and the removal tool comprises a handle and a pair of legs, the pair of legs configured to be received by the pair of holes, respectively.

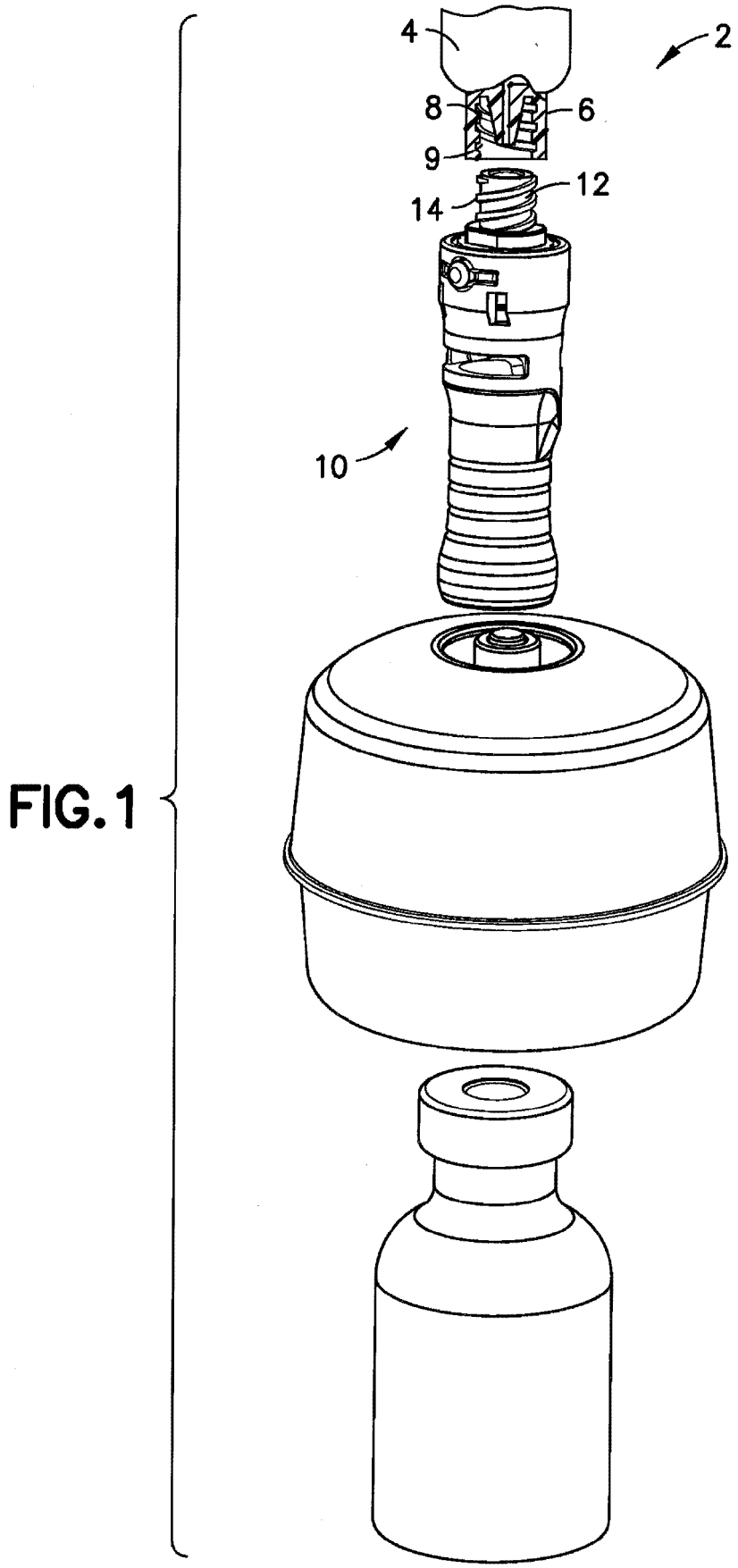

FIG. 1

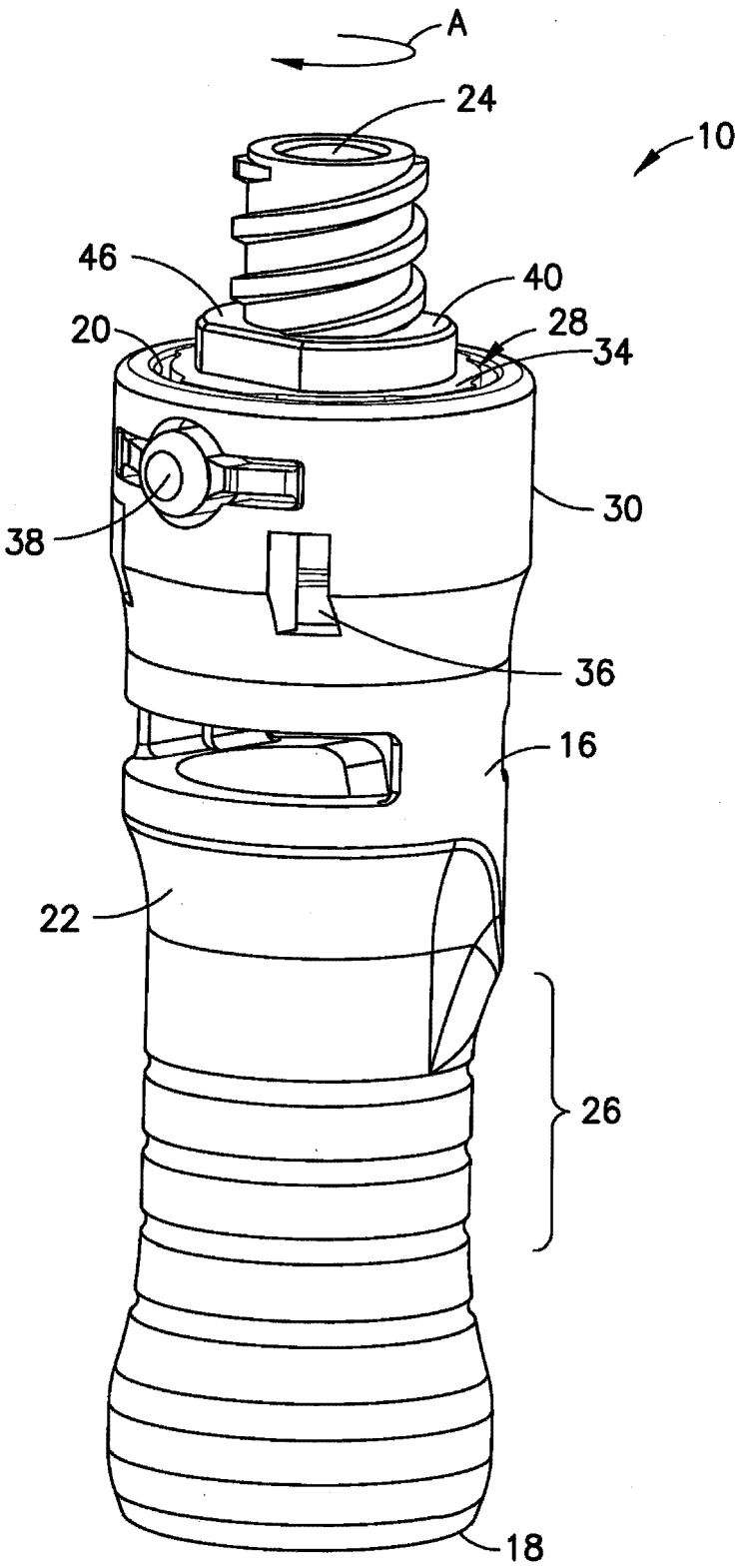

FIG.2

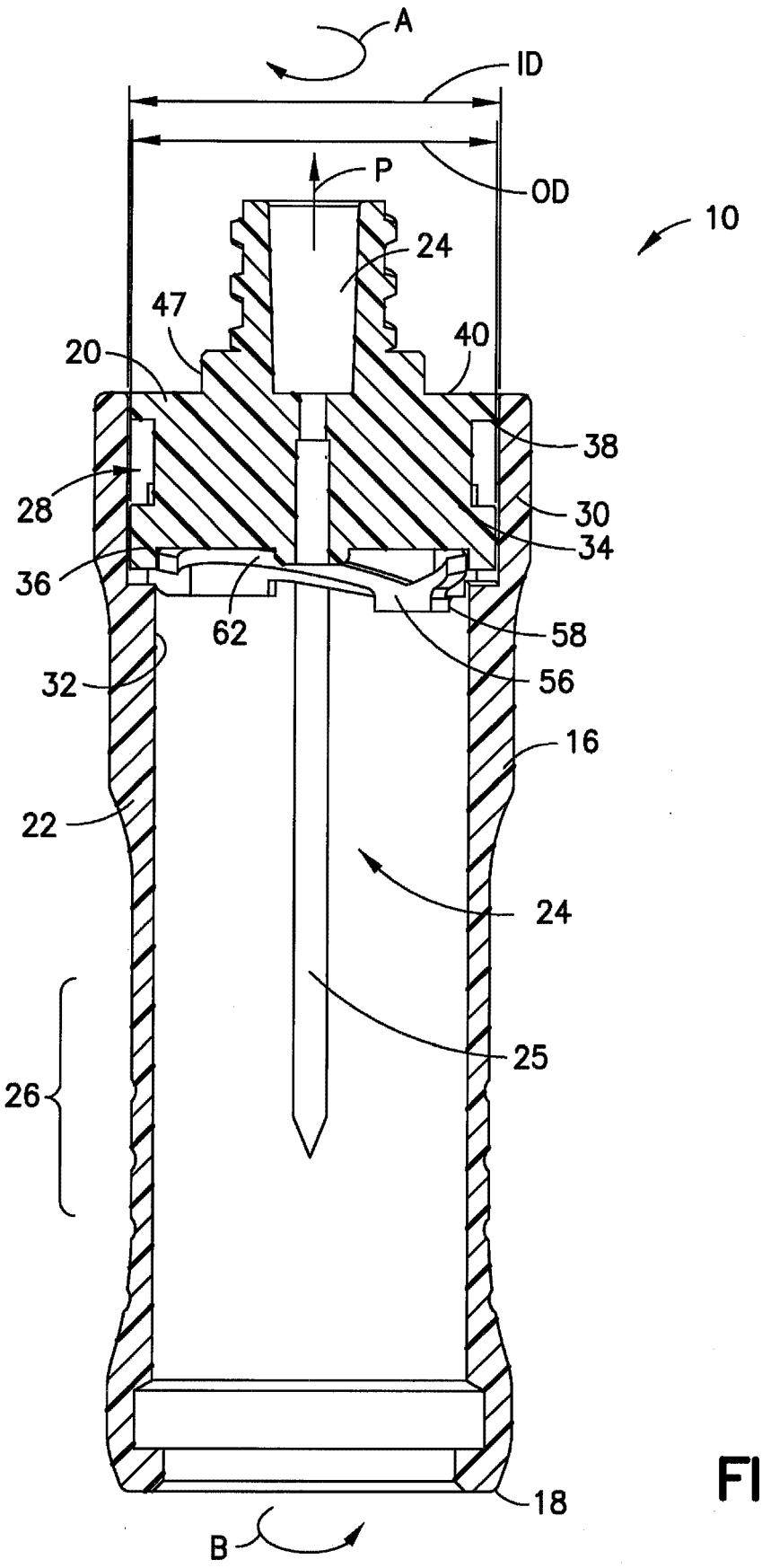

FIG.3

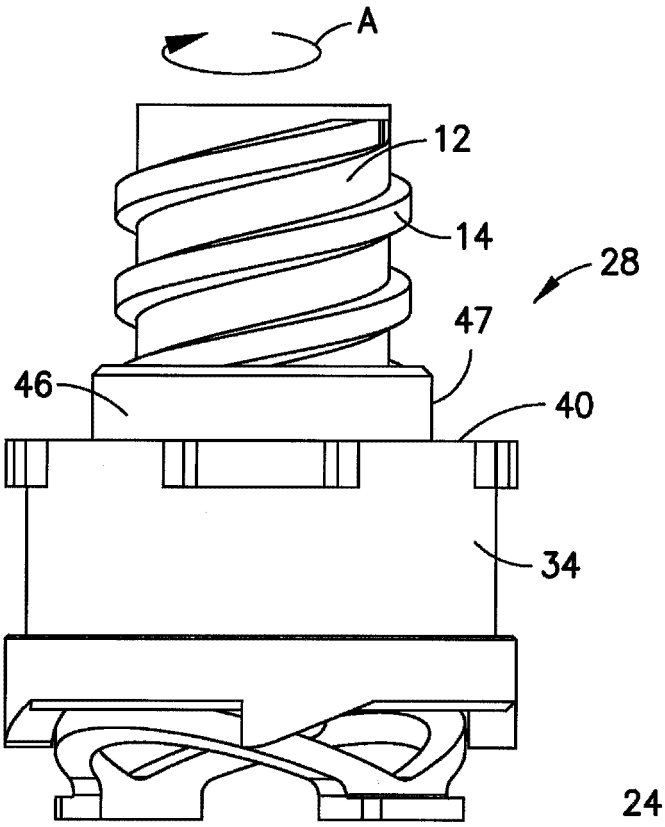

FIG.4

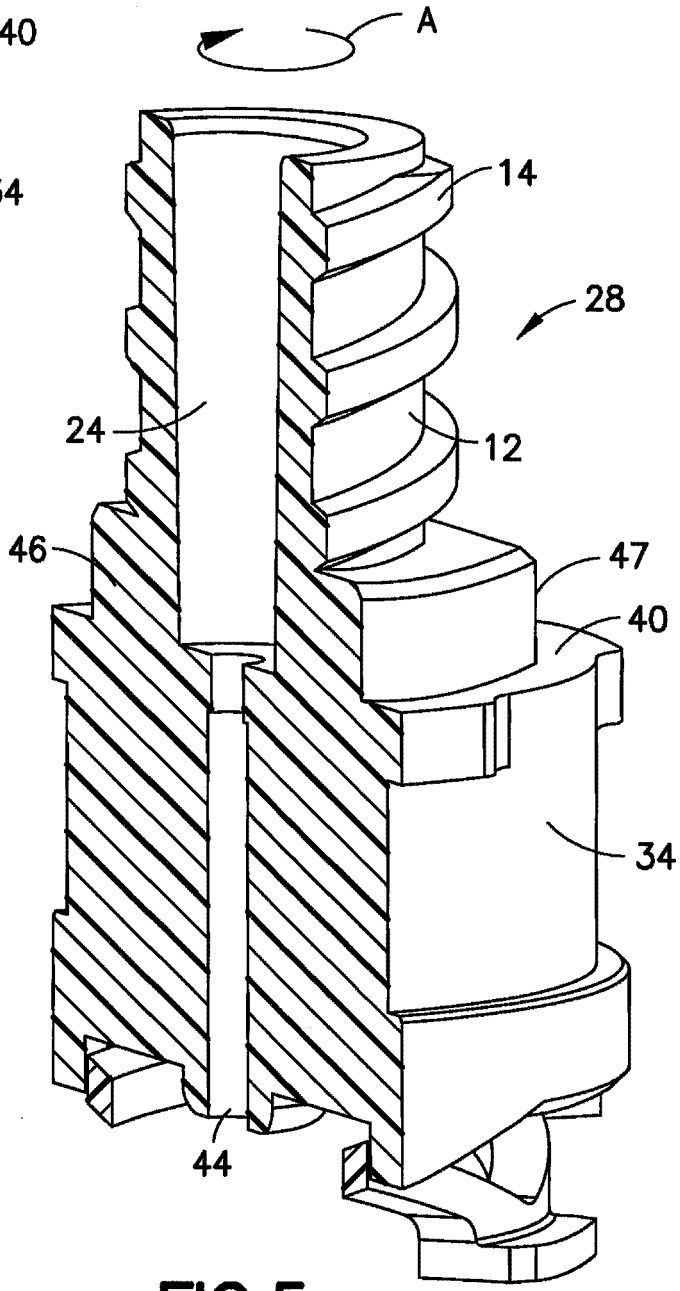

FIG.5

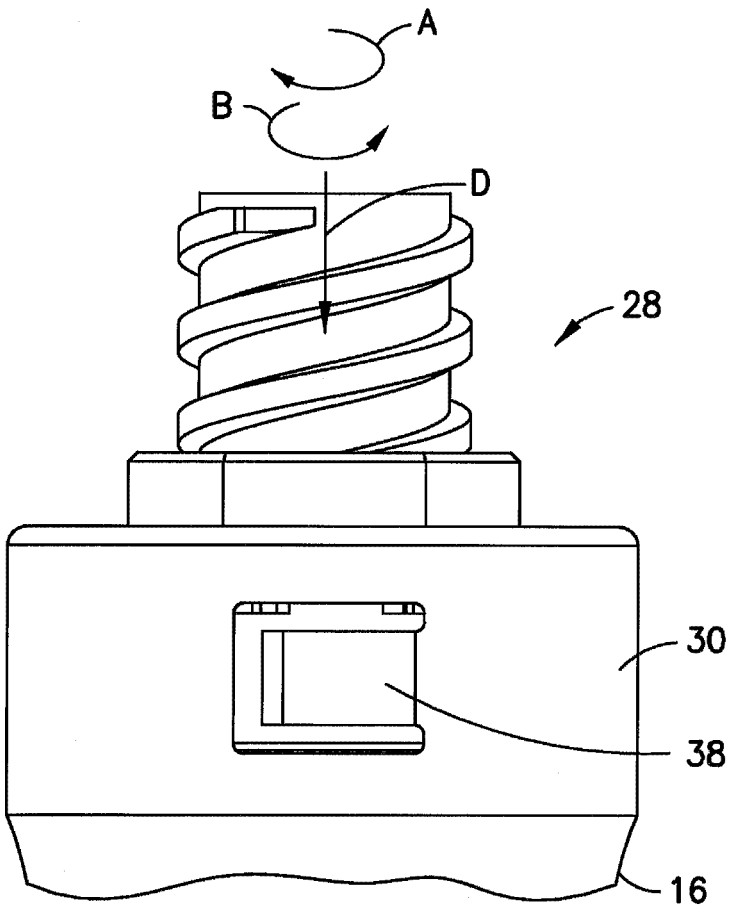

FIG.6A

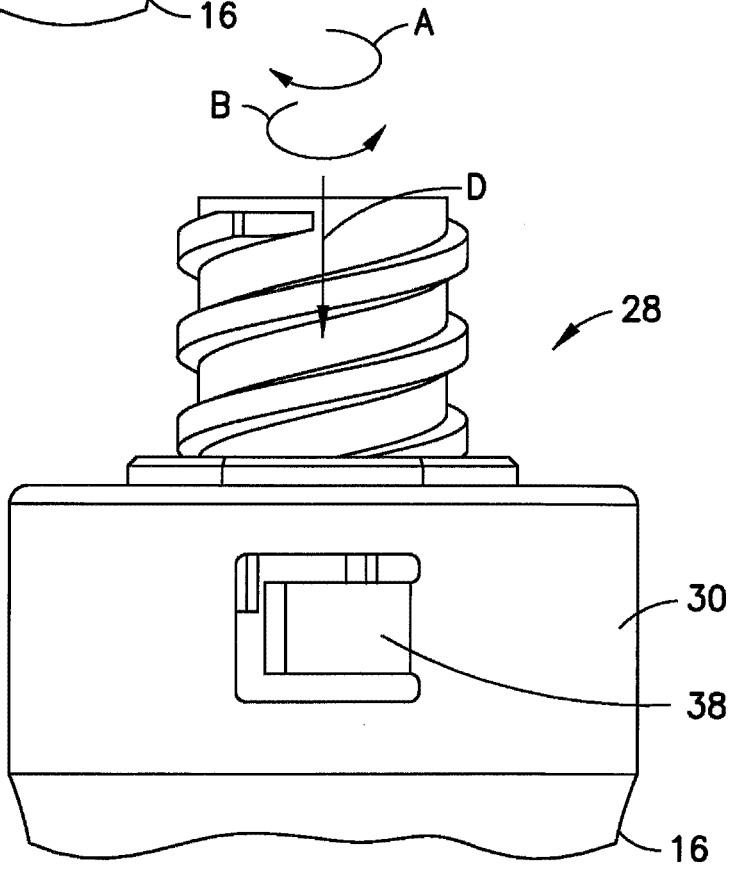

FIG.6B

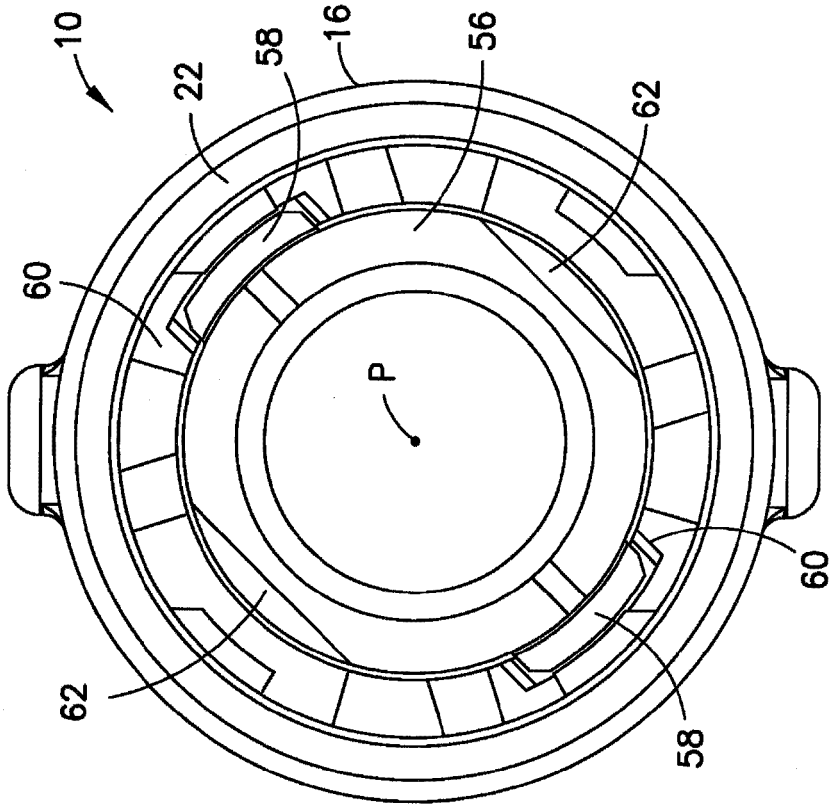

FIG.8

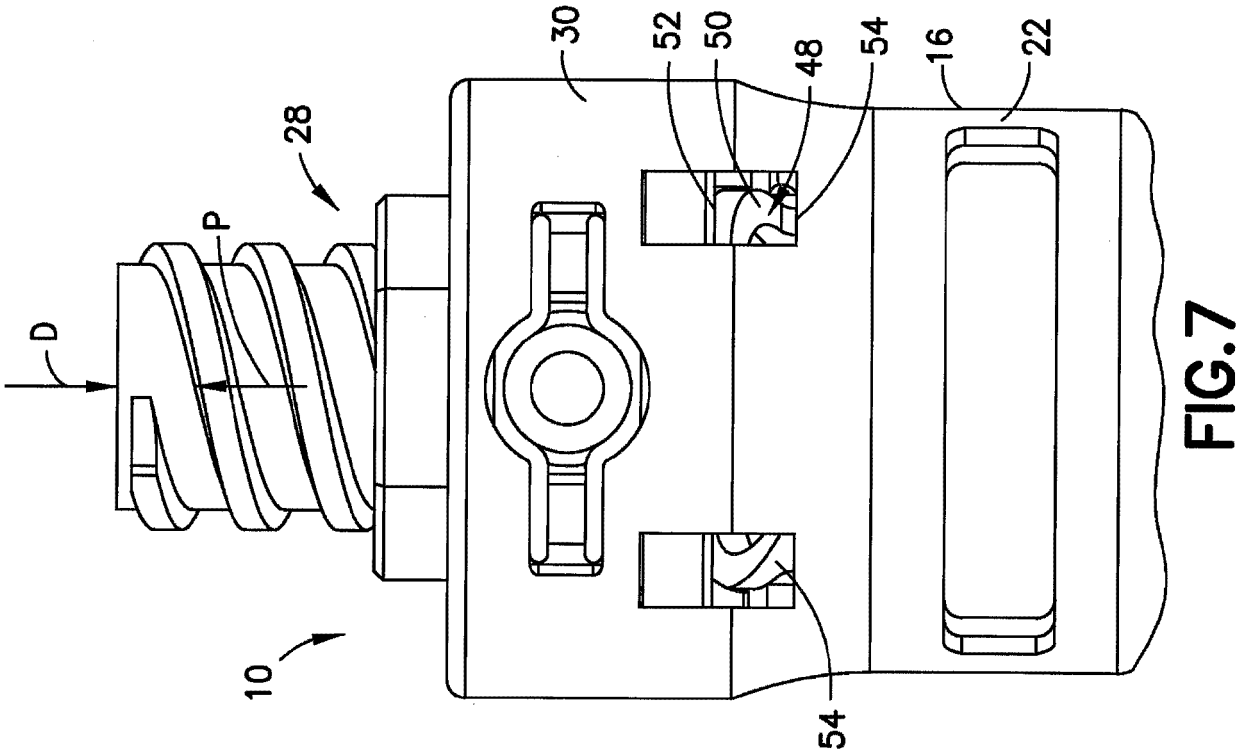

FIG.7

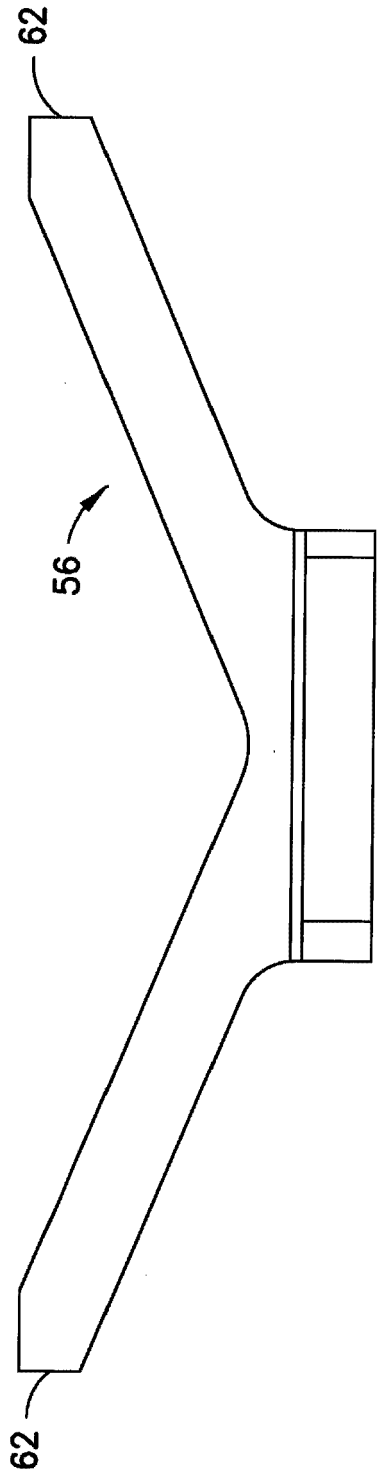

FIG.9A

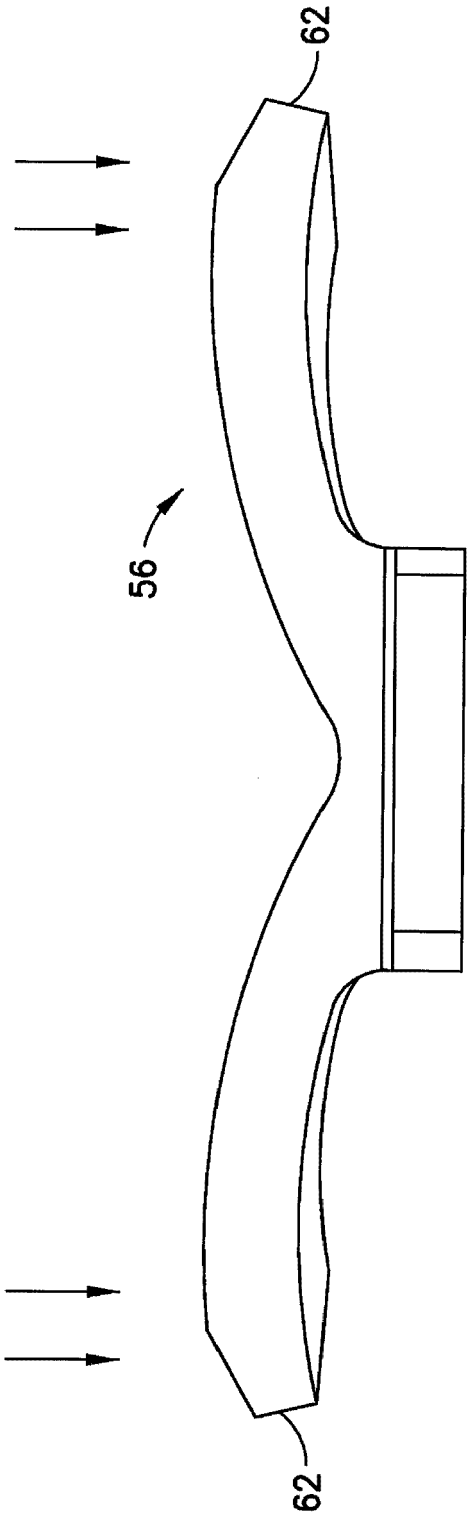

FIG.9B

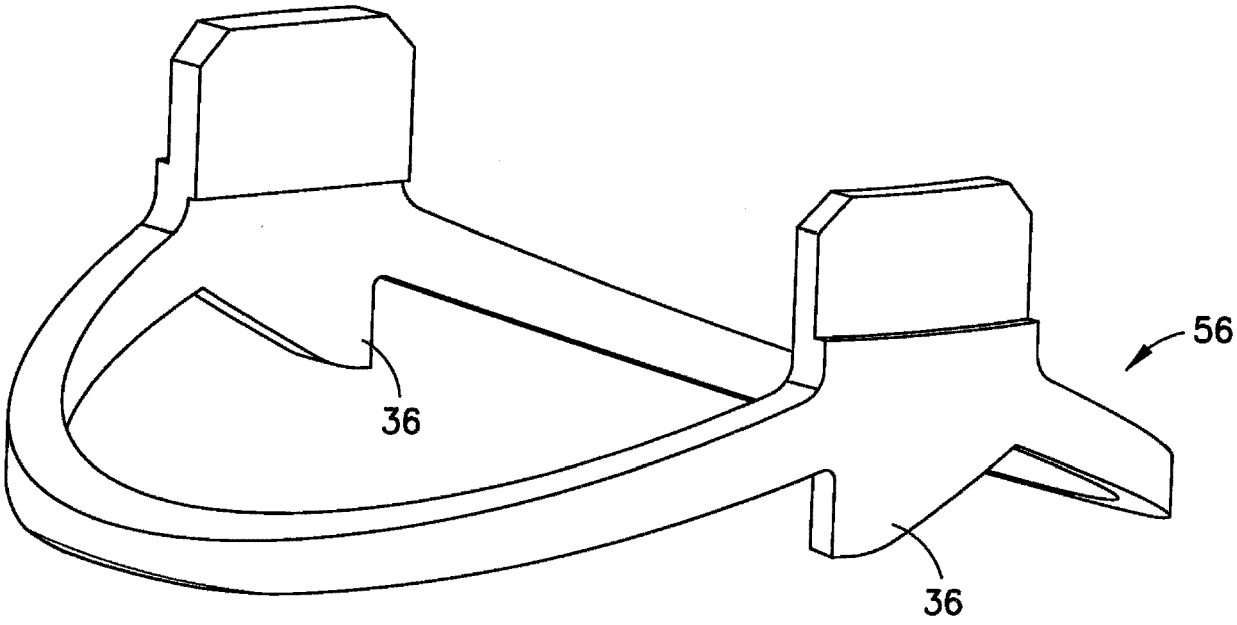

FIG.10

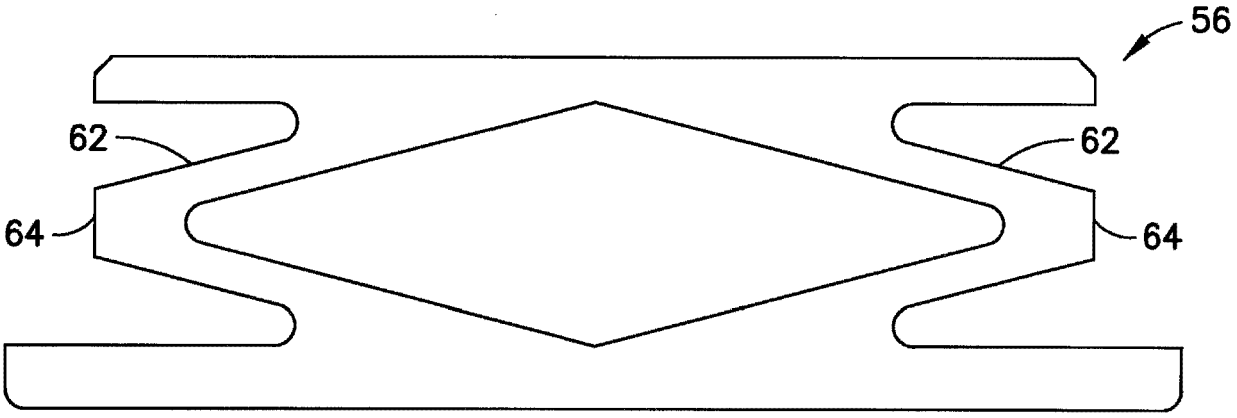

FIG.11

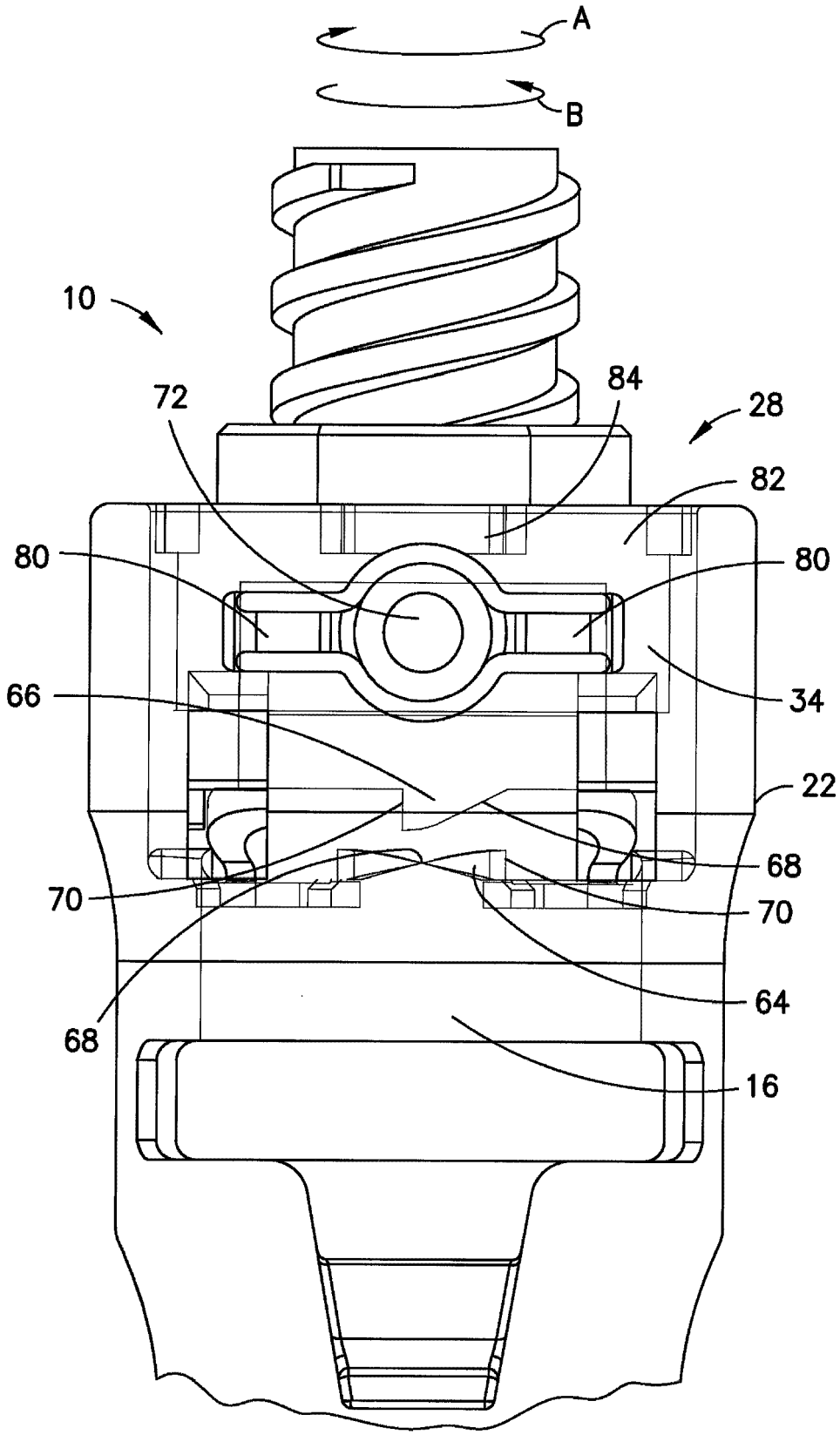

FIG.12

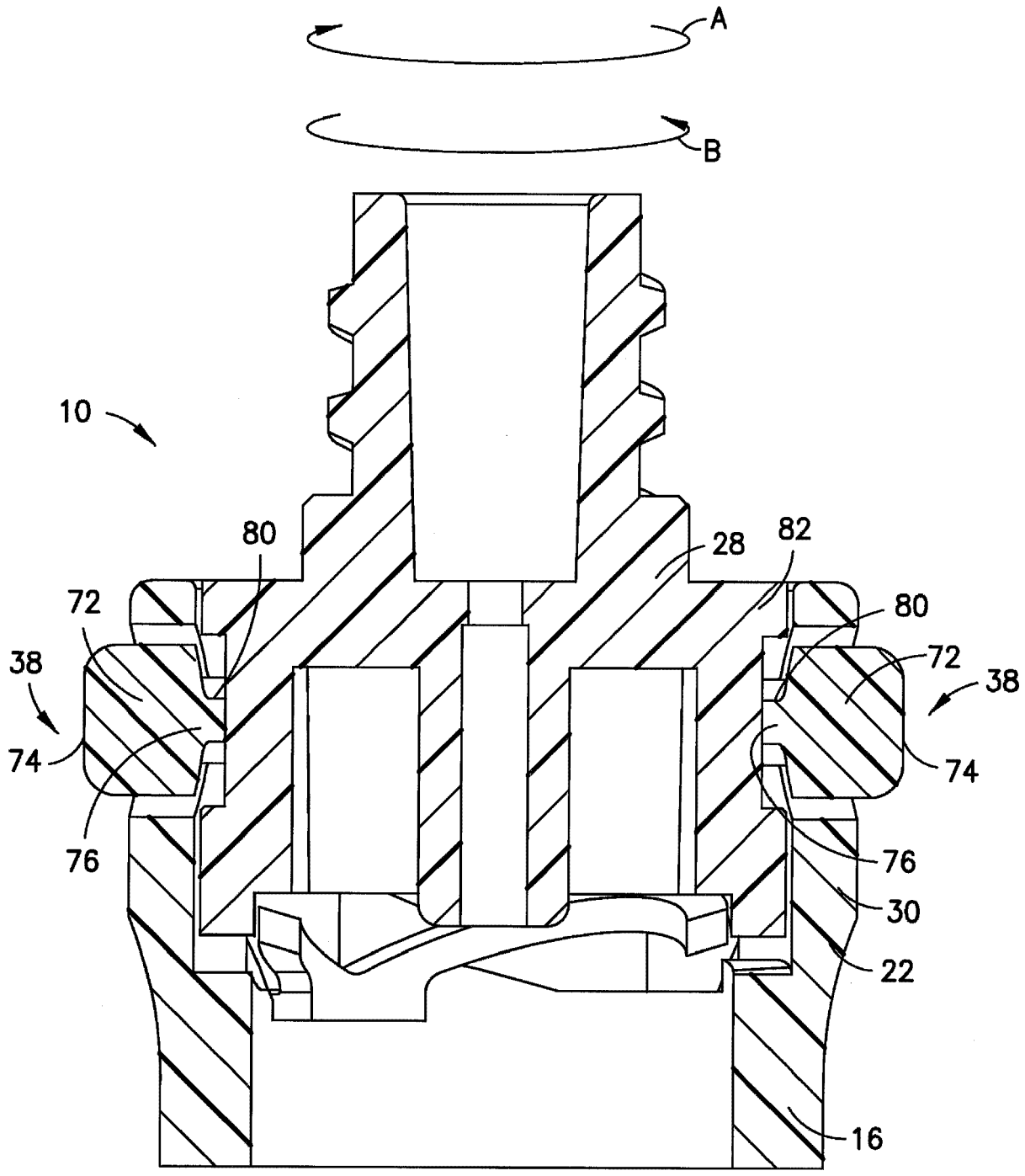

FIG.13

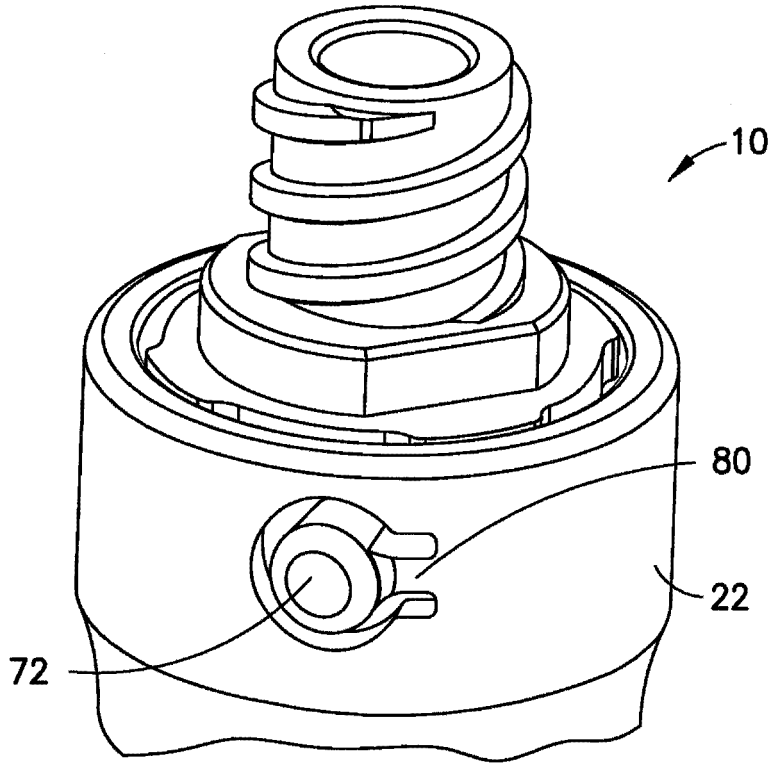

FIG.14

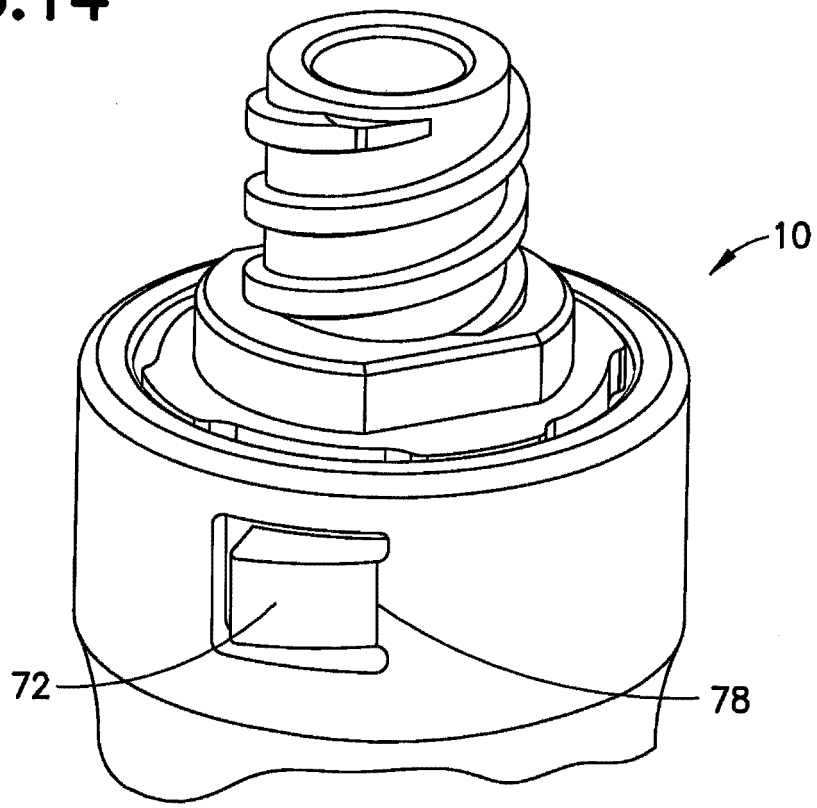

FIG.15

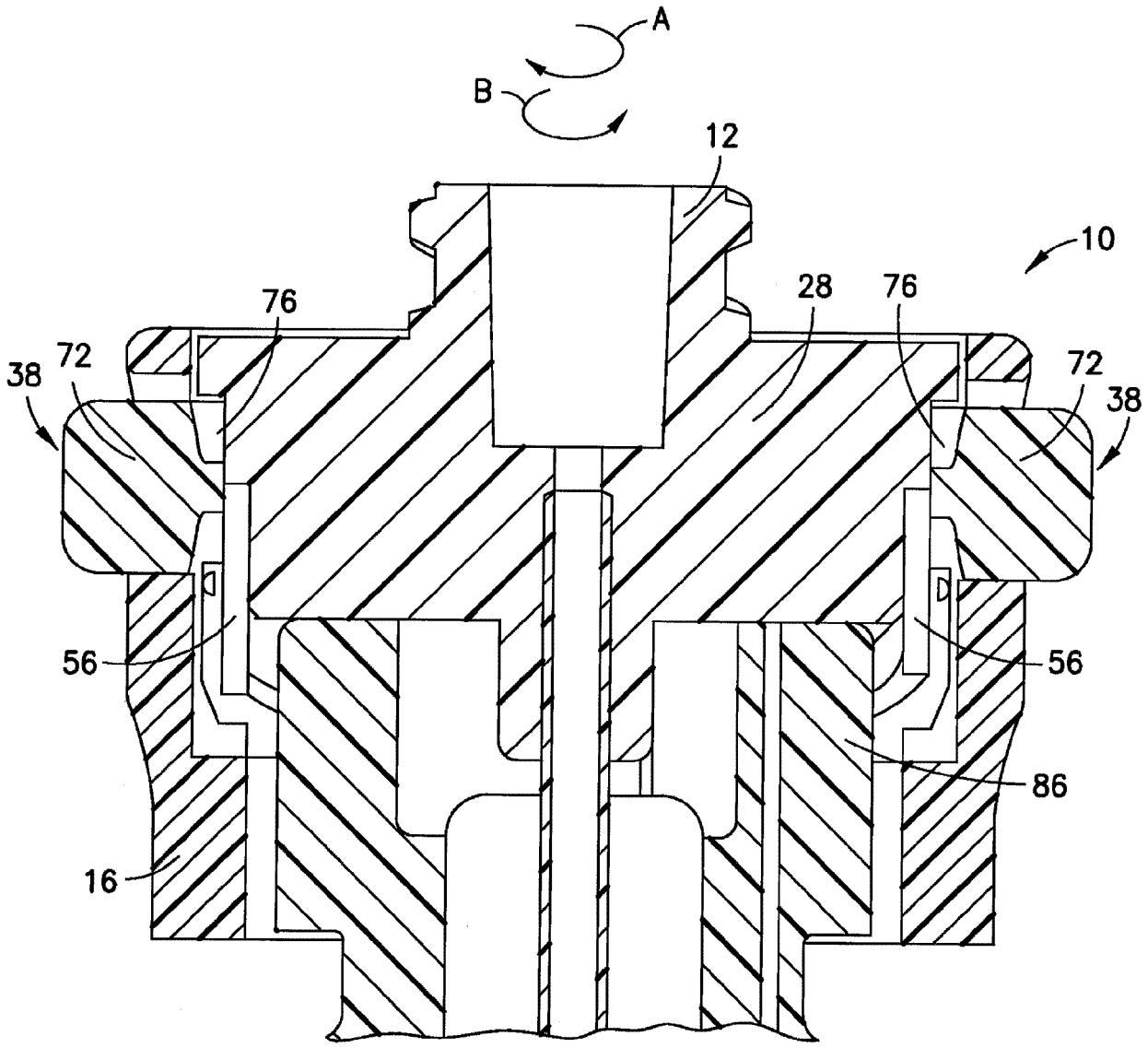

FIG.16

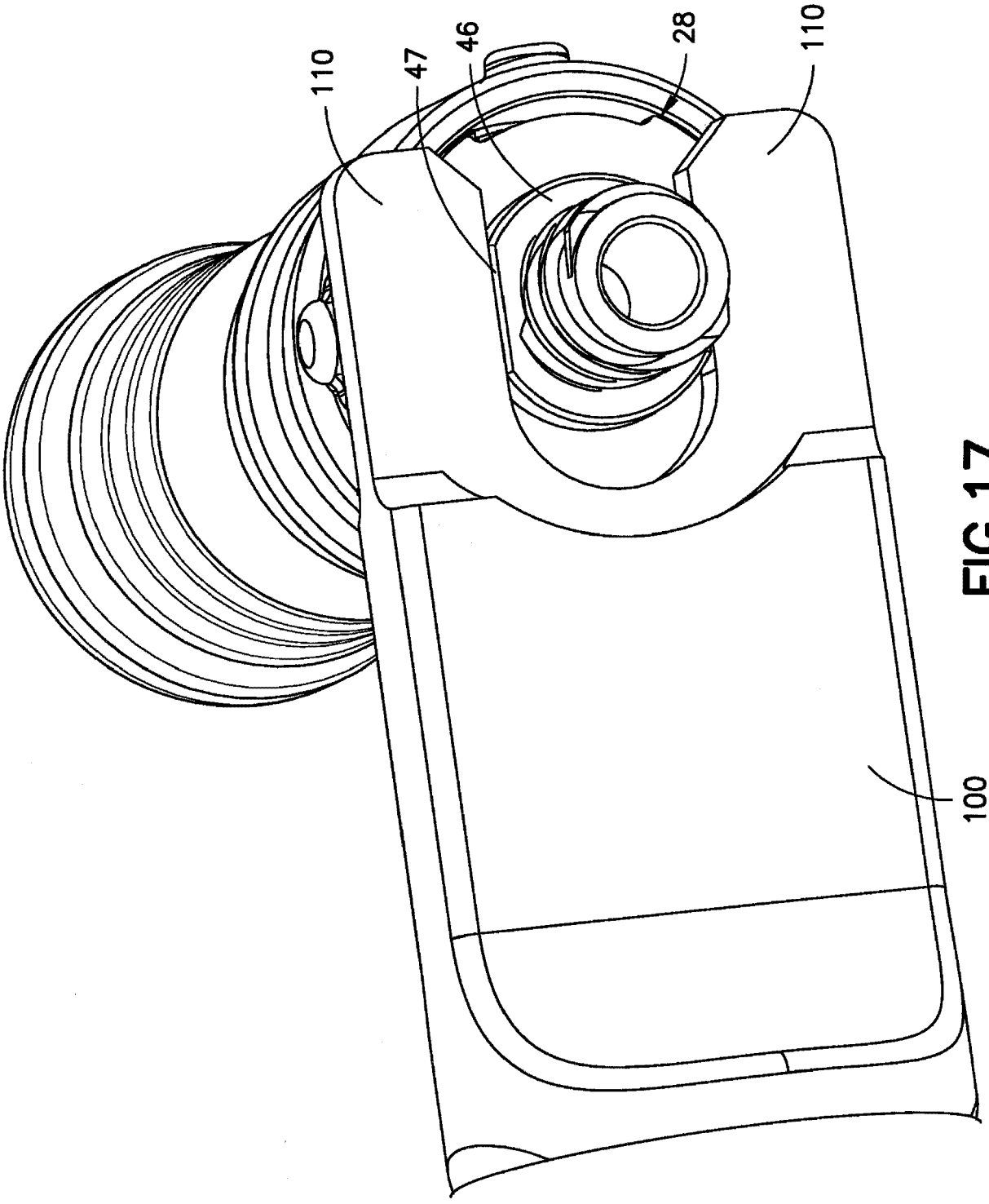

FIG.17

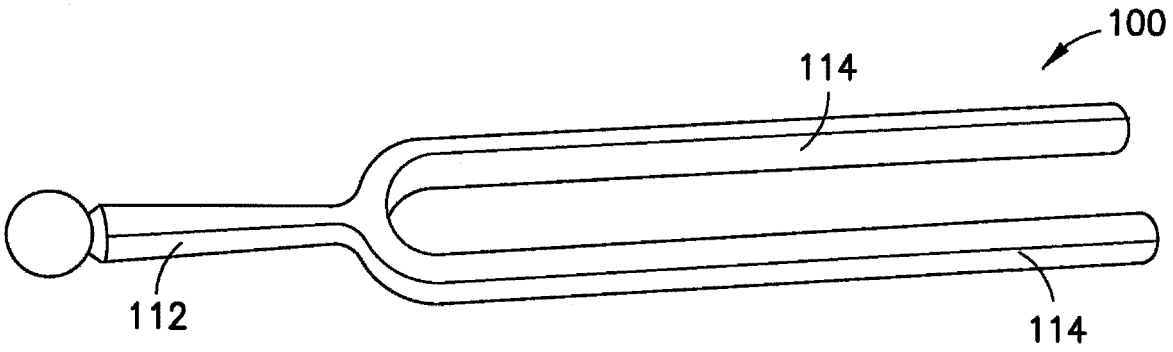

FIG.18A

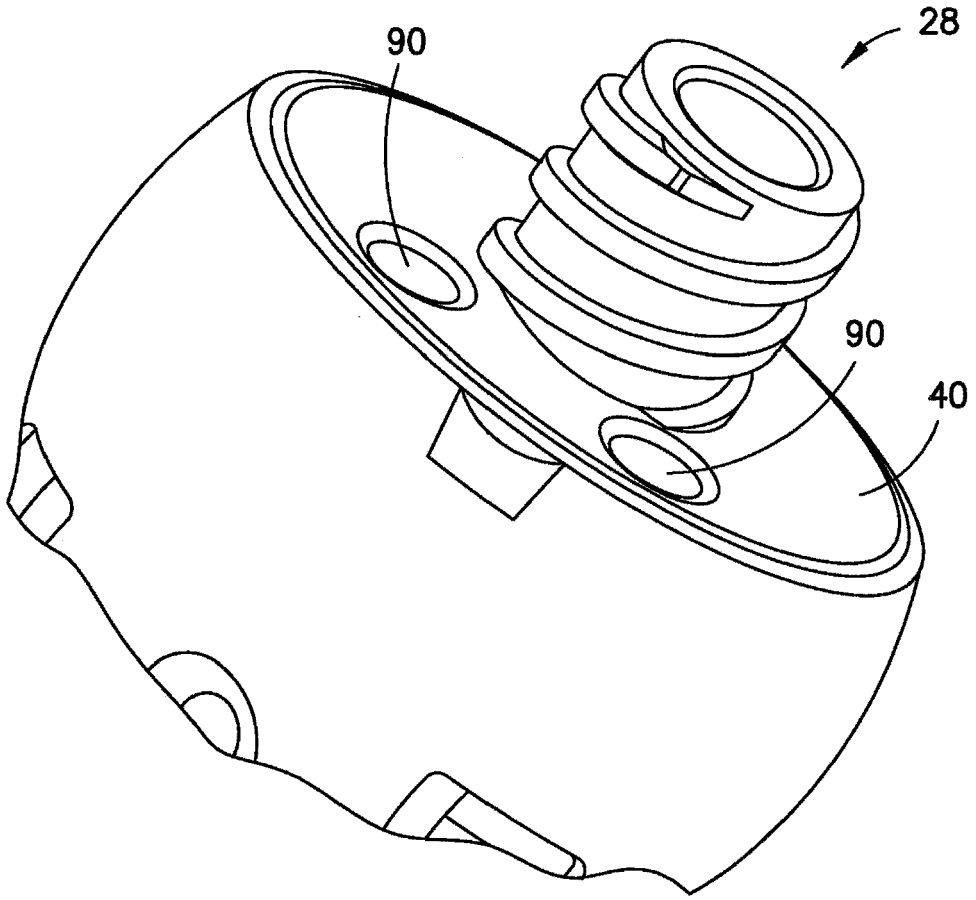

FIG.18B

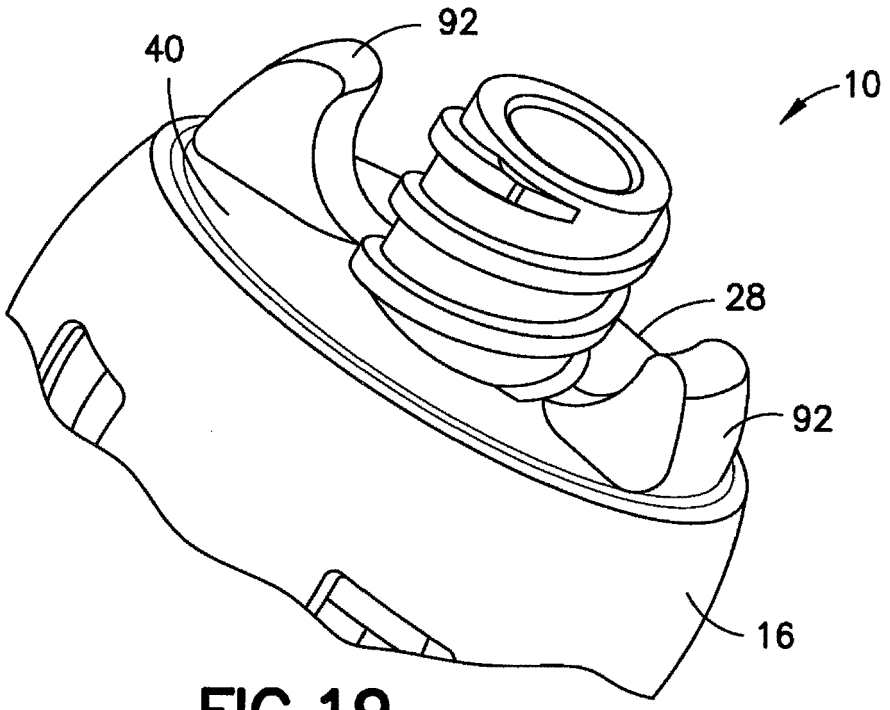

FIG.19

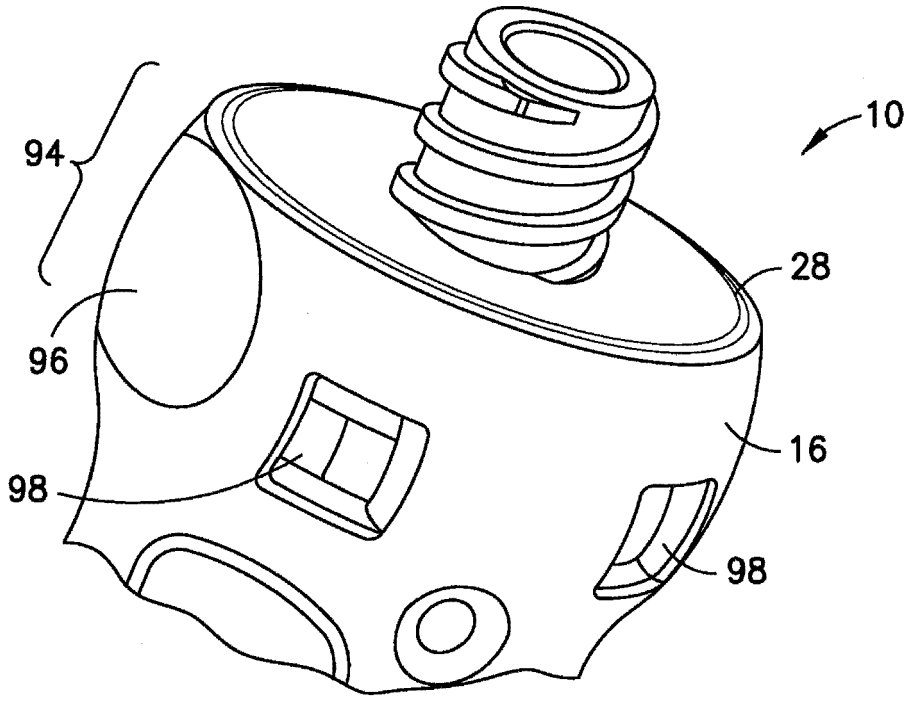

FIG.20

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 18 17 1078

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	WO 2011/150037 A1 (J & J SOLUTIONS INC [US]; GARFIELD JARED MICHAEL [US]; KOPLIN RANDALL) 1 December 2011 (2011-12-01) * paragraphs [00101], [00114]; figures 3,4 *	1-15	INV. A61J1/20

TECHNICAL FIELDS SEARCHED (IPC)

A61J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	29 June 2018	Gkama, Alexandra

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 18 17 1078

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

29-06-2018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2011150037 A1	01-12-2011	AU 2011258371 A1	13-12-2012
		CA 2800278 A1	01-12-2011
		CA 2891798 A1	01-12-2011
		EP 2575734 A1	10-04-2013
		EP 2944302 A1	18-11-2015
		EP 2959877 A1	30-12-2015
		EP 2959878 A1	30-12-2015
		EP 2959879 A1	30-12-2015
		EP 2959880 A1	30-12-2015
		EP 3210588 A2	30-08-2017
		IL 223243 A	29-10-2015
		IL 241697 A	30-04-2017
		JP 5789296 B2	07-10-2015
		JP 6073416 B2	01-02-2017
		JP 6073421 B2	01-02-2017
		JP 6073422 B2	01-02-2017
		JP 6073423 B2	01-02-2017
		JP 6073424 B2	01-02-2017
		JP 2013526968 A	27-06-2013
		JP 2015186609 A	29-10-2015
		JP 2015211879 A	26-11-2015
		JP 2015211880 A	26-11-2015
		JP 2015211881 A	26-11-2015
		JP 2015231535 A	24-12-2015
		MX 348044 B	25-05-2017
		NZ 603808 A	31-10-2014
		NZ 627328 A	29-01-2016
		NZ 629637 A	24-12-2015
		NZ 714715 A	25-11-2016
		US 2013066293 A1	14-03-2013
		US 2015209229 A1	30-07-2015
		US 2015209231 A1	30-07-2015
		US 2015209234 A1	30-07-2015
		US 2015209235 A1	30-07-2015
		US 2015209572 A1	30-07-2015
		US 2016250102 A1	01-09-2016
		WO 2011150037 A1	01-12-2011

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82